two-thirds Bohemian lignite and one-third Bohemian coal. The area of the fire-grate of the gas generator is, in proportion to the section of the kiln, as 1 to 2¼. If the area of the fire-grate of the generator is increased, the most intense heat can be obtained in the kiln. With the advantages offered by this mode of burning and the total absence of ashes and smoke in the kiln, it is easy to burn very high-class goods of a delicate colour, which it is difficult to do in the Hoffmann kiln with direct firing. We may observe that the Hoffmann kiln, of which a large number are in use in this country, can be easily converted into gas-kilns on the Escherich principle. In view of the advances made both in England and on the Continent by the Thomas-Gilchrist process, it may be interesting to note that Mr. Escherich has made arrangements to construct a gas-kiln for burning the basic bricks required by a German steelmaking firm which employs this process. As the kiln for this purpose is required to be of small capacity, only burning 5000 kilos per week, it is to be modified somewhat for this special purpose, and will be based on the regenerative principle in connection with Mr. Escherich's vertical gas-pipes. The notion of burning basic bricks on the continuous principle had to be abandoned, as the production would have been too large for the present demand. We should add that this kiln is now being introduced in England by Mr. Hermann Wedekind, of 158, Fenchurch Street, London, E.C. From the successful results which have attended its working in several places on the Continent, where it is in use for various purposes, we shall expect to see it making its way into practice in our own country so soon as its special merits become known. These merits are not so much the saving of fuel as the ensuring of a good colour and quality in the goods burned in it.

THE PISTONLESS INDICATOR.

(*See illustration, page* 273).

Although a steam-engine indicator in which that objectionable element, friction, does not exist has long been a desideratum, the want has remained unmet down to the present time. It is true that several important improvements have been made in the details of these instruments from time to time, still the indicators in general use are very defective. This arises from the impossibility of making the piston tight without incurring considerable friction, thus necessarily causing unreliable diagrams. Every one conversant with the indicator has experienced this, and must also have noticed that where the steam is "silty" the friction increases to such an extent that the piston binds so tightly as to become jerky and even immovable. Further, with a high initial pressure in cylinder and a sharp cut-off, the weight of the piston in the instrument (especially in its descent) considerably distorts the figure. To remedy this the pistonless indicator illustrated in the accompanying engraving has been devised after careful study by Mr. Kenyon, and is now being introduced in this country by Messrs. Isaac Storey and Sons, of the Knott Mill Works, Manchester. The express object in view with the inventor was to remove the objectionable piston, retaining at the same time the best features of the ordinary piston. The oval tube, commonly known as the "Bourdon Tube," but with important improvements in section, is used instead of the piston. This tube has long been acknowledged the best pressure-gauge, and few engineers will dispute its superiority over a piston for this purpose. Hence the importance of its introduction in the indicator will be readily understood by our readers. The working of the instrument is facilitated by the addition of a detachment motion which has been devised by Messrs. Storey. By its use the paper drum is instantly released from the revolving cord drum, allowing of the removal or examination of the diagram without the inconvenience, delay, and sometimes danger caused by having to disconnect and connect the cord giving motion to the indicator.

THE PRODUCTION OF MARTIN STEEL RAILS FROM WORN-OUT IRON RAILS.

By N. Lilienberg.[*]

(*Continued from page* 238.)

Melting.

The materials used at Graz, with the exception of the malleable iron and steel scrap, are first heated and introduced into the furnace in the order denoted by the Roman numerals in the table given above, showing the composition of the furnace charges. By previous heating a more equable temperature may be maintained in the melting chamber. Besides, in this way the time during which the iron rails are exposed to oxidation is diminished, because the flame can be kept reducing in the furnace in which this previous heating takes place. Into Pernot's furnace, on the other hand, the pig-iron and scrap are introduced cold, for in it the melting down goes on more rapidly.

The previous heating in a separate furnace involves the inconvenience of a good deal of labour in the transport of materials, and there is a loss of heat from the doors being more frequently opened. In order to avoid this an attempt was made at Graz to heat the materials in spaces under the gas-inlet into the furnace, but the heat there was found to be too great at the same time that it was lessened in the fusion chamber.

The order stated above for introducing the separate charges, has been found advantageous for a rapid melting. As it is difficult to determine beforehand the quantity of the pig-iron, inasmuch as it ought to be regulated mainly according to the heat in the furnace, a portion of it is kept back in order to be introduced into the furnace in the necessary proportion along with the last charge of wrought-iron scrap and iron rails. The escape of gas in the metal bath, in combination with slag-tests, gives the best indication on this point. Although it is possible to put a stop to the former by introducing in the second addition of pig-iron a larger quantity of silicon and manganese, this course is not advisable, on account of the risk of having a surplus of silicon, which has a highly detrimental influence on phosphoriferous steel rails. Into the first pig-iron bath, which, in furnaces Nos. 2 and 3, consists of about two tons, cold wrought-iron scrap is thrown before the iron rails, which are more difficult to dissolve, and thus require an equable undisturbed heat. In this way, too, the metal bath is sufficiently large to cover the rails, and thus prevent too great waste. The iron rails ought, for the same reason, to be cut in lengths of 3½ feet, and introduced on a shovel right over the deepest place, *i.e.*, over the hole for running out the metal.

A new addition of materials is not made until the preceding has been dissolved. When it is ascertained that the last rails have been dissolved and when the mass has been rendered as uniform as possible by stirring with a rabble, a test is made by hammering out a cast cake, 3 inches in diameter and 1½ inches thick under a steam hammer, to a diameter of 6 inches and a thickness of ⅜ inch., hardening it at a gentle brown heat, bending it and hammering it together when it ought to be continuous to half the thickness. Should the test specimen break quite through at the bend, it is in general sufficient to wait for about half an hour for the hardness to be sufficiently diminished. This ought not to be brought about by throwing in wrought-iron scrap, because the furnace ought to be left during the last period to take a very high heat. A great departure from the normal test shows that there has been some fault in the management of the furnace.

If the metal is found to be too hard, spiegeleisen heated to redness is immediately thrown in. The quantities that have been specified above are the smallest that ought to be used, but in case the metal has been found to be too soft, more spiegeleisen must be added, on which account a surplus of about 40 kilog. ought to be at hand in the heating chamber. As compounds of manganese, especially when the proportion of manganese is large, do not mix readily with steel, care must be taken to make sure not only that the whole has been dissolved, but also that the mixture is as complete as possible. This, in general, occasions a delay of ten minutes, after which a new sample is taken.

The hammered-out plate ought not, as in the foregoing test, to show ragged edges. After hardening, it ought to snap when bent to about 120°. At Graz they believe they have found that a specimen containing 0·1 per cent. phosphorus and 0·2 per cent. manganese snaps when bent to 160° when it contains 0·35 per cent. of carbon, when bent to 130° with 0·30 per cent., to 120° with 0·25 per cent., to 90° with 0·20 per cent., and to 45° with 0·15 per cent. Along with this angle the surface of fracture ought also to be noted. By these indications the right degree of hardness can be judged of without difficulty.

If the test has been found satisfactory the metal is run out, which is done by removing the loose sand in the hole through which the metal runs, and by breaking through with a sharp-pointed rod the sand which has run together. When the furnace is warm this is done without difficulty, but with the first charges in a newly-built furnace, it happens sometimes that in front of the hole there is "cold-steel," which can only be loosened by hammering. While running out, the metal clears out the hole, so that it is eventually opened to its full extent. In the larger furnaces this hole is formed of an earthenware tube in two halves with a breath of 180 and a height of 200 mm. As the furnace is rapidly emptied of its contents through so wide an opening, a stopper is held against it when the most of the metal has run out, in order to retain the slag, while the last of the metal runs out under the stopper. When this has taken place the stopper is removed and the slag allowed to run freely.

As the whole of the metal is run into one ladle, the last ingot is not softer than the first, which, on the contrary, usually happens when the metal is run direct into the moulds. The casting can also be carried on in this way with greater care and without spilling, and there is the additional advantage that the furnace work is not delayed by a tedious casting process. These advantages perhaps more than compensate the somewhat greater cost of a crane and ladle than of a revolving table, the difference besides not being very great, as the former can be used for several furnaces, and the latter only for one.

The moulds at Graz are so arranged that they stand in pairs connected together. The metal is run into the outer mould, and rises in the inner. In the way half the number of ingots are more compact than the other half, a difference which is perceptible by the number of blowholes on the surface. The only scrap is the small quantity of metal, about 1·5 per cent., which remains in the earthenware pipe. From a 10-ton charge there are obtained thirty-four to thirty-six ingots, weighing 225 to 285 kilog. each. Greater variations ought not to arise, and may be easily avoided in casting from a ladle. Every time the furnace is emptied one of the ingots is made to weigh 300 kilog. in order that one of the rails may have an excess of length which is used for testing.

After the furnace is emptied the metal and slag are cleaned out, being scraped down to the outlet hole, the wide opening of which considerably facilitates the work. The bottom of the furnace is attacked more by the slag than by the pure metal, on which account repairs have to be made mainly under the gas inlet where the the covering of slag lies on the bottom. There the injured part of the bottom is carefully broken up with a sharp-pointed rod, and scraped down with a scraper. In the damaged places quartz sand is put, which is brought in on a shovel, with which it is carefully levelled. If this work is well done the bottom will outlast several rebuildings of the furnace. Three hours after the metal has been run out, at the latest, the furnace ought to be again in order and sufficiently heated to receive a new charge of pig-iron. The time required to melt down and heat up the separate portions of the charge is shown in the following table, in which the Roman numerals refer to the portions of the charges in the table given above:—

			Furnace No. 1.					
Charge ..	327	328	329	330	331	332	333	334
			o'clock.					
I.	8·30	10·30	9·15	7·30	8·0	7·0	4·50	1·45
II.	10·25	12·45	11·15	9·45	10·0	8·13	7·0	4·0
III.	1·25	3·30	2·0	12·0	12·15	11·45	9·30	7·40
Spiegeleisen ..	4·50	6·25	5·20	5·05	4·0	2·20	12·33	10·10
Metal run out ..	5·30	6·40	5·30	5·15	4·10	2·30	12·43	10·30
			Furnace No. 2.					
Charge ..	401	402	403	404	405	406	407	408
			o'clock.					
I.	2·30	5·0	8·30	12·15	3·0	4·40	8·15	11·0
II.	5·30	8·45	12·0	3·40	6·15	8·15	11·40	4·15
III.	9·35	12·25	4·30	7·30	9·45	12·15	3·30	8·0
Spiegeleisen ..	1·40	4·40	8·45	11·50	1·55	4·55	7·20	12·0
Metal run out ..	1·50	4·50	8·55	12·0	2·05	5·0	7·30	12·10
			Furnace No. 3.					
Charge ..	362	363	364	365	366	367	368	369
			o'clock.					
I.	10·45	2·45	5·20	7·45	10·30	1·30	3·10	11·45
II.	2·45	6·40	9·40	11·45	2·0	4·45	6·30	5·0
III.	6·20	10·30	1·0	3·0	4·30	6·07	12·30	8·10
Spiegeleisen ..	10·40	2·35	4·20	6·55	9·0	11·40	6·35	2·45
Metal run out ..	10·50	2·45	4·30	7·05	9·10	11·50	6·45	3·30

From this it appears that the time occupied by the process is very variable, depending partly on the difference of the temperature in the furnace, and partly on its construction and size.

In the smaller furnace, No. 1, about two hours are required for the melting of 1½ tons of pig and ½ ton of scrap, and about three hours for dissolving two tons of iron rails. From the emptying of the furnace to the introduction of a new charge there elapse from one to three hours, according to the amount of repair which the furnace bottom requires. In this way on an average a 6-ton charge occupies 10 hours 45 minutes. In the larger furnace, No. 2, about three hours go the melting down of 2·1 tons pig-iron, and 1·3 ton scrap, and about four hours to the dissolving of each of the succeeding portions of the charge. After the furnace is emptied, about three hours elapse before it can be refilled. On an average 14 hours are required for a 10-ton charge. In the case of furnace No. 3, results were less favourable, the time required being rather more than 15 hours, the reason being that these charges were the last before the rebuilding of the furnace which was very much burned.

(*To be continued.*)

The Sanitary Institute of Great Britain have accepted the invitation to hold their annual congress in Exeter this year.

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[*] From *Jernkontoret's Annaler*. Vol. xxxiv.

OCCASIONAL NOTES.

THE DEBRIS QUESTION IN CALIFORNIA.

Of all unnecessary things the precious metals are the most costly to mankind. Even in California and Australia, when the wages of labour and returns for capital invested are compared with those obtained in the same localities, at the same time, in other occupations, gold and silver mining has proved a loss to both. This is apart from the moral and material loss consequent on the conditions of the occupation, and the stimulus to gambling and to all kinds of immorality which it gives; and hydraulic mining, as it is practised in California is, besides, ruining the agricultural land and choking up the rivers. The Bear, Yuba, Feather and Sacramento have already been filled with mining *débris* to such a degree that their waters have in many places left their beds and devastated the fertile lands adjoining; and as there is believed to be enough of "pay dirt" in the gravel deposits of the State still existing for a century more of hydraulic mining, if it is allowed to go on, in less than that time it is expected that there will scarcely be a trace of a river-bed existing, and vast tracts of agricultural land will be reduced to the condition of deserts of sand and gravel. Lieut.-Col. Mendell, of the Board of United States Engineers for the Pacific Coast, has made a report on this subject to the authorities at Washington, which has just been published. Nearly all the mischief he records is produced by hydraulic mining, that is by making water do the work that in other methods is done by machinery or manual labour. It is so inexpensive a process that a profit may be made out of it when the gravel or earth contains threepennyworth or less of gold in the cubic yard, and it has been carried on upon so large a scale that as early as 1854 the Sacramento River, opposite the city of that name, had been filled over the extent of two miles to a mean depth of 15 and a maximum of 25 feet, and now the tide which used to rise two feet at Sacramento stops nine miles below it. Since the date named the filling up has been going on continuously. This choking up the rivers also causes the flood waters to spread over the adjoining farms, covering the land with mud and stones, and the elevation of the river beds increases the area of these destructive floods, while all the country depending on the rivers for communication finds the efficiency of the navigation impaired. Col. Mendell recommends that the detritus should be held back in the side cañons by damming the rivers in their upper portions, and he is of opinion that unless this is successfully done, or hydraulic mining stopped, the destruction of the navigable rivers of the interior will be almost inevitable; while the *débris* will be spread over the land for miles along their course. The area of surface torn up to produce this *débris* is estimated to have amounted in 1862 to ten million acres, and it has been nearly doubled since then. On the Yuba and Bear Rivers about 300,000,000 cubic yards have been deposited, about a half in their beds and the other half over the plains they water.

THE LONDON WATER SUPPLY.

A lively controversy on this question has been proceeding for some days in the leading journal. The points of the discussion are mainly the proposed purchase of the metropolitan waterworks by the State; but the wholesomeness of the commodity dealt in by the water companies has been incidentally introduced. Mr. E. J. Smith, after making out a fair case for the Government in the matter of the proposed transfer takes upon himself to vouch for the purity of the supply, and boldly alleges that the analysts can find no practical difference between spring and Thames water. Mr. Jabez Hogg, in reply, correctly describes "the truth as quite otherwise." In the very last report issued by Dr. Frankland, the Kent Company's (spring) water being taken as unity, that gentleman states the proportion of organic impurity in the Grand Junction and Southwark Companies' supply as 7·0, in the Lambeth and New River as 6·0, and in the East London as 5·3. These are the chief sources of the metropolitan supply. The analyst adds that the water distributed during the last month by the Southwark, Grand Junction and Lambeth Companies was in a condition quite unfit for dietetic purposes, and that that of the last two contained "moving organisms." The question really seems to be not whether the money offered for the London waterworks is too much or too little, but whether works, the water distributed from which is unfit for drinking purposes and alive with moving organisms, ought to be purchased at all.

THE "STORES" CONTROVERSY.

The movement against co-operation organised by certain vestrymen does not seem to have had much influence in the late election contests. The fact is that the opposition to co-operation on the part of the tradesmen is so exceedingly illogical and so evidently selfish that there is great difficulty in formulating it; and all the arguments brought against the existing stores tell quite as much against the gigantic private establishments which preceded them in point of time, and which must have been quite as detrimental to the smaller men in their neighbourhood. And what are called co-operative stores are simply competing joint-stock establishments, where cheaper and better goods are sold than in the smaller shops. The tendency towards such undertakings has been growing for a good many years, and the avarice and extortion of the shopkeepers themselves have been the real cause of the introduction of the joint-stock principle into the retail trade. The fussy individuals who are engaged in the agitation might just as well call for the abolition of railway companies, joint-stock banks, building societies, or any other of the innumerable companies which are existing and increasing in the country. One advantage of the stores, even if they should not become the sole means of distribution, will be the education of the customer in prices and qualities of articles of ordinary consumption. The private shopkeeper must henceforth deal honestly and fairly if he is to live at all, and his prices and qualities must stand comparison with those of the goods in the store price lists.

THE THAMES AND THE SEWAGE OUTFALLS.

Last week the arbitrators in the dispute between the Metropolitan Board and the Thames Conservators as to the alleged obstruction of the navigation of the Thames by the sewage outfalls at Barking and Crossness, closed their enquiry, after sitting twenty-five days. The investigation was an elaborate one, and the witnesses examined of the highest standing as scientific or practical experts. The case as presented by the Conservators was not that the banks complained of were wholly composed of sewage, but that the introduction of floculent matters from the outfalls so matted and entangled the ordinary river mud as to cause increased precipitation, besides rendering the silt useless economically, having substituted for a sand which would have been taken away by private dredgers, a filthy mud which nobody would touch except at a large cost. There can be little doubt of the general truth of this assertion, for the glutinous matter in the sewage must not only entangle the sand in suspension in the river, but sink it more quickly to the bottom and hold it there. Indeed such is the adhesive character of the new deposits, that banks have been formed, seven or eight feet in thickness, in portions of the river where from the rapidity of the current such accumulations had never before been known. Any one who has seen and smelt the layers of black mud left bare by the receding tide in the Thames below the sewage outfalls, must see the force of the Conservators' case. It is very plain that the true method of disposing of the metropolitan sewage has not yet been arrived at; and as this obnoxious matter moves up and down the river with the tide, a portion of it, no doubt, as far as the intake of some of the water companies, it will be evident that more important interests are involved in its proper disposal than those of navigation, important as they are.

A VENTILATING HOUSEBUILDING MATERIAL.

It is not generally known that a considerable quantity of the external air may enter a house through the pores of the bricks of which it is built; but the 'Mudians use for house-building a material much more pervious to the atmosphere in certain sorts of coral which are firm and compact as well as porous. The coral rock which forms the atols and barrier and fringing reefs of the islands of the South Pacific becomes very dense and hard under the action of the sea water, so as to be able to resist the impact of the tremendous surge which breaks upon it; and in that state it is often as crystalline as the finest marble. The more porous qualities are lighter; but wherever there are coral growths, this utilisation of a natural product remarkable in many ways would appear to be equally favourable to the beauty of the dwellings and the health of their inmates.

EXHIBITION OF BUILDING APPLIANCES, AGRICULTURAL HALL.

The comparatively novel feature of a series of special Trade Exhibitions is being energetically carried out at the Agricultural Hall, Islington. We have, in the course of the last few months, had occasion to report upon exhibitions of brewers' and soda-water machinery, and the Hall is now occupied by a very good collection of all appliances and materials used in the building trades. There is no doubt that these collections of special appliances in different trades form a most convenient means of showing, in a condensed form, all the latest improvements in any trade; and architects, builders and engineers would do well to profit by the excellent collection of material at the present Exhibition. We understand that the Exhibition will remain open for a second week, as it is thought that its existence is not as publicly known as it might be. It is to be hoped that the Press notices this week will serve to draw further attention to its merits.

Passing now to the details of the Exhibition, there is much of interest in the Wood, Joinery, and Joiners' Fittings Class. Mr. Robert Adams of 7 Great Dover Street, shows an excellent sash fastener, which enables the sashes to be pressed tight into their places, and will catch when not completely closed, and by its vertical position when unfastened is much more conspicuous than the ordinary sliding catch. His door-spring also is ingenious and very useful, as possessing the novel feature that the resistance of the spring reduces as the door opens, to allow for the difficulty experienced in pushing a spring door fully open. Mr. Patrick O'Connor, of Wavertree, Liverpool, shows excellent fittings of a similar character. His automatic catch for a spring door, in conjunction with a rubber buffer, is very ingenious. His combined latches and locks are very neat and much more compact than the separate latch and lock. His door-handle that opens by an eccentric drop is quite unique, and very useful for servants when loaded with a tray. In joiners' work, Messrs. H. Atkinson and Co. show some excellent substantial work in factory sashes and hospital doors. Their school desks for ladies are models of neatness, simplicity and elegance. Messrs. Colman and Glendenning, of Chalk Hill Works, Norwich, make a specialty of their school fittings, and their "single desk," with desk and seat for the next pupil in front, both carried on the same standard, is the simplest, most ingenious, and cheapest thing we have seen in this line. Messrs. Esdaile and Co., of the City Saw Mills, Wenlock Road, N., and Vauxhall Cross, S.W., draw considerable attention to their American and Swedish doors, and their trellis work is very firm and well put together. Mr. Frederick Sage, of 60, Gray's Inn Road, shows the handsomest pair of doors in the Exhibition. They are panelled in a variety of coloured woods and beaded with ebony, the result being most artistic. In shop blinds Messrs. Clarke and Co., of Rathbone Place, Oxford Street, show a very handsome metallic front, fitted with their well-known noiseless self-coiling steel shutters, and Messrs. Salmon, Barnes and Co., of Ulverston, Lancashire, also show an ingenious balanced coiling-shutter, in which the roller is automatically adjustable, so as to always keep the shutter vertically in its grooves. We should not leave this class without an appreciative note as to the excellence of Messrs. Bartholomew and Co.'s (Ropemaker Street and Finsbury) exhibits of extremely cheap but elegant pine furniture. A handsome oak sideboard of entirely new design is the principal novelty in their exhibit.

In the Class of Bricks, Stone and Concrete, the most attractive exhibits in glazed bricks of different colours are those of Messrs. Eastwood and Co. (Limited), Lambeth, and of Messrs. Joseph Cliff and Sons, of King's Cross. The former firm have a specialty in red and white moulded bricks, which are exceedingly tasteful, and suited to the modern æsthetic taste. The majolica ware of the latter firm both on tiles and on faced bricks, is the most novel and most artistic thing we have seen for inside and outside wall decoration. The Victoria Stone Company, of Stratford and Kingsland Road, show some capital samples of their now well-known artificial stone, which for durability is unequalled. An enormous cylinder, apparently for drain pipes, is the latest novelty in this material.

The brick building trades meet with severe competition from several concrete building firms. Messrs. Chas. Drake and Co. (Limited), of Battersea Park, Mr. J. M. Tall, of Dulwich, and the Patent Concrete Building Company, of Blackfriars Road. If the statements that concrete buildings can be erected at a saving of 30 per cent. over brick building are duly realisable there should be a large future before concrete as a building material. Mr. Lascelles, of Bunhill Row, also shows some splendidly finished moulded windows in his patent concrete, equal in every respect to stone.

Turning to the Class of Machinery the ubiquitous Mr. Hindley, of Dorset, exhibits his well-known cheap and excellent combined engines and boilers, and shows a new and neat form of horizontal engine that looks strong and serviceable. Messrs. Crossley Brothers, of Queen Victoria Street and Manchester, exhibit their now well-known "Otto Silent" gas-engines, which for small powers are almost entirely superseding steam, wherever gas can be readily supplied. In wood-working machinery, Messrs. Reynolds and Co., of Southwark Street, show a very large selection of their circular and band sawing machinery. Mortising and mitre-cutting machines. Messrs. Polyblank and Co., of Newton Abbott, also show some good examples of circular and band sawing machines in this class. The only novelties we noticed were in planing machines. One, Shell's patent, manufactured and exhibited by Messrs. Thos. Middleton and Co., of Southwark, is an excellent plane, and has a large future before it. It planes, by fixed planes, both sides and edges, and finishes with a surface equal to the best smooth planing and scraping, ready for the polisher. The machines exhibited are for only 7 inches and 3½ inches width of laths or planking; but we understand that machines are in hand to plane up to 26 inches in width for railway-carriage panelling, for which we anticipate a considerable application of the machine. It will plane from 300 to 500 feet per minute under steam-power with soft wood. The other new planing machine is that of Messrs. M. Powis, Bale and Co., of Budge Row, who also exhibit several other moulding, mortising, and sawing machinery. Their new planing machine is particularly adapted to the planing of laths for Venetian blinds, the finish being excellent, ready for the paint. The top and bottom surfaces are worked by fixed planes, and the edges are rounded by rotating cutters at a high speed. The speed with which the laths are passed through the machine, perfectly finished, is startling.

One of the most noteworthy of all the wood-working machines is the patent dove-tailer of Mr. Tighe Hamilton, which is exhibited by the well-known cabinet-makers, Messrs. Howard and Sons, of Oxford Street. This machine perfectly makes the pins and tails of the finest or coarsest description for all classes of dove-tailed work, for boxes, drawers, or parquetry. The principle of this machine is a vibrating circular saw, which is driven by a "drunken" eccentric, and regulated into a vertical plane by a restraining motion. We hope shortly to give an illustrated description of this interesting machine.

In indiarubber and its adaptation to the commercial purposes of packing, bands in combination with cotton, and in hose lined with rubber, Messrs. Anderson, Abbott and Anderson, of Queen Victoria Street, and Messrs. Davis and Henwood, of Budge Row, are the two principal exhibitors. The cotton-covered driving belts and rubber-lined hose of the first firm, and the rotating rubber valves of the latter firm, are best worth attention as valuable novelties.

In the class of Sanitary Appliances the entries are very numerous and the exhibits very interesting and voluminous. Messrs. Robert Boyle and Son, of Glasgow and London, are conspicuous by the get-up and artistic designs of their exhibits. Their self-acting air-pump ventilators are too well known to require further description, and we would only say that this firm have given their best attention to elaborate complete and systematic plans for the thorough ventilation of dwelling houses and public buildings. Messrs. Verity Brothers, of Euston Road and Regent Street, show some very interesting mechanical ventilating machines. They use small horizontal water wheels, driven by high-pressure pin-hole jets from the water main, to rotate a small horizontal fan by which a strong current of air is set moving in the required directions. We hope to give further illustrations of these novelties. Messrs. William Smeaton and Sons, of Moorgate Street, hold the most conspicuous position for excellency of exhibit in sanitary appliances for closets and lavatories. Their waste preventer attached to their closets seems perfect of its kind, and gives a double flush to the pan. The "Eclipse" trap of this firm has been so successful that it is found difficult to meet the demand. This trap is cast in lead, so that the relative levels of the soil-pipe from the pan and the issue of the trap are always insured to be accurate, which is far from being the case in hand-made traps. There are no corners left for accumulation of deposit, and the form of trap prevents syphoning over. A completely new arrangement of wall lavatory is exhibited by this firm, in which the wash basin in enamelled iron closes up to the wall when finished with, and is secured there by a hasp, so that the whole arrangement closes into some three inches in width. Messrs. C. Kite and Co., of Euston Road, show a very effective fixed ventilator, suitable for churches, cow sheds, or stables, and a fixed cowl, which we tested to be a thorough safeguard against smoky chimneys.

Mr. James Edward Ellison, of Leeds, draws attention, by his conical perforated bricks, to the important fact that a current, which, in a parallel tube, would be felt as a violent draught, becomes perfectly innocuous when delivered through an expanding cone. In concluding this class, we must not forget the Banner system of ventilation, the valuable invention of Banner Brothers, of Billiter Square, which we have lately fully explained and illustrated in our journal.

In the class of Mantelpieces and Kitcheners, Messrs. Wells and Co., of Shoreditch, undoubtedly hold the pre-eminence in the magnitude and quality of their exhibits, which comprise some splendid specimens of marble mantelpieces, with designs in bas-relief, a splendid selection of kitcheners, and some excellent samples of builders' iron work. The other most noticeable exhibits in this class were those of Messrs. Yates, Haywood and Co. (Limited), of Upper Thames Street; Messrs. Steel and Garland, of Holborn Viaduct; and Messrs. Ashton and Green, of Bury Street, St. Mary Axe.

In Gas-economy we noticed the excellent system of double combination flame exhibited by G. E. Webster and Co., which effects the long-desired desideratum of doing away with the ineffective purple part of the gas jet, and thus giving a jet incandescent throughout. The economy effected is at least a third, which is well proved by a model test gasometer. Quite new things in domestic machinery are the butter-washing, or potato-washing, machines of Messrs. F. and C. Hancock, of Dudley, Worcestershire. The butter or boiled potatoes are squeezed by screw pressure out of a perforated cylinder, which effectually triturates the potato, and in water cleanses the butter. The dough-kneading machine of this firm is a most simple and useful machine, as it dispenses with the handling of the dough entirely, and from a testimonial we inspected it is much liked.

A noticeable feature in the Hall as the day declined is the Electric Light (Harrison's patent), the property of the Sun Electric Light Company, exhibited by Messrs. Powis, Bale and Co. This light is very steady, and of a beautiful colour. The lamp mechanism is extremely simple. No clock-work or complicated electric motive-power is used. The weight of the descending carbon is sufficient to take up the waste. Both carbons are fed together by the weight of the upper, and a balance-weight if needed, so that the carbons approach in exact proportion to their waste, and consequently the light is always in a constant position. The feed is regulated by a friction-brake, operated by the intensity of current, and a contact-breaker to ensure the arc is operated by an electric arc.

Under Sanitary Appliances we may include the very necessary art of perfect and rapid water filtration. This is most effectually obtained by Mr. P. A. Maignen, of 22, Great Tower Street, with his "Filtre Rapide." He has now perfected its application to water filtration by some valuable additional improvements since our last illustrated article upon this filter. He finds that felt is an infinitely more rapid filtering covering for his frames when used with powdered charcoal than the canvas he before used. He also now introduces an air-supply into his filtering frames, so that perfectly flat rain water may not only be filtered pure and bright, but is also rendered palatable and sharp to the taste.

SCIENCE AND ART.

PROCEEDINGS OF SOCIETIES.

SOCIETY OF ENGINEERS.

(*Continued from page* 258).

Messrs. Robertson, Osborne and Co., manufacture a horizontal steam winch of 6 inches diameter cylinder, 10 inches stroke, the lap of valve being $\frac{1}{2}$ inch and the lead 1-16 inch, and regulated by the ordinary link motion. The gearing is wheel and pinion, first power being 5 to 1, with a pitch of $1\frac{5}{8}$ inch, and the second power 1 to 2 with a pitch of $1\frac{1}{2}$ inch, thus representing 10 to 1 when working double-purchase, and are constructed to lift 3 tons single purchase, the power being changed by jaw clutches and the usual levers. They are provided with powerful friction brake chain barrels 12 inches diameter and 2 feet 10 inches clear of brake wheel, warping ends and chain wheels to windlass and pumps. All shaft journals are bushed with brass and capped, so that they can be lined up and generally overhauled without interfering with the fixtures of the machine, connecting rods top and bottom being coupled with bolts and brasses, valve spindles passing through back of valves and secured with double nuts, the copper pipes with stop valve connecting cylinders being flanged to valve casing and not to door, so that the valves can be examined without breaking pipe joints, the exhaust steam and water formed in cylinders at starting passing into pipe cast in sole plate and then over ship's side by malleable iron pipe and coupling. The total deck space occupied over all is 4 feet 6 inches by 6 feet 9 inches, that is, from end of cylinders to outside rim of crank disc and across cylinders. This is a little more than is taken up by the diagonal type, but the great advantage accruing not only to the winch itself, but to the ship's decks from the centre of piston strain on crank and centre of barrel left being nearer the sole plate or holding down centre amply compensates for the extra space required, the winch and decks lasting longer and giving more satisfaction to all parties. In discharging cargo this size of winch is considered equal to fifteen men, and will load or discharge 20 tons per hour of pig-iron or other slung goods of this class, and bale goods, such as linen, cotton, &c., at the rate of 40 tons per hour, and requires 20 to 25 cwt. of common Scotch coal per twelve hours' constant work with a pressure of 40 lb. to 45 lb. steam, and will take about thirty men to lift anchor with, say, 45 fathoms of chain. A ship of 1000 tons can be managed with three hands less, but speed being the great object the same number of hands are generally kept. For a 1000-ton ship this size of winch is ample, but for over this tonnage for heaving anchor a 7-inch cylinder winch is preferable.

They also manufacture ships' steam deck cranes, specially arranged for loading and discharging ships, especially where the cargo has to be loaded or discharged from lighters, a method very generally adopted in foreign ports; with a slight modification they are suitable for wharf, railway, and general purposes, in which case they can be made portable or fixed, all being arranged to hoist, lower, or turn round separately or simultaneously as desired. These cranes are fitted with a pair of 6-inch diameter cylinders, the gearing and general details being same as steam winch, the slewing and mitre wheels being of malleable cast iron and centre column or spindle of solid forged iron extending to lower deck, where it is received by a strong step plate, the top part of column being bored out and forming a steam passage to cylinders. They are arranged for same lifts as the winches, 3 tons single-purchase, and are sometimes placed in centre of ship and sometimes to port or starboard. The jib is on red pine with iron sockets.

In using Browne's patent fresh-water condenser, the steam at 25 lb. to 30 lb.. which generally gives the best results, enters at an inlet aërator, and through a pipe to the series of condensing boxes where it is completely condensed, and then into cooling worm tinned outside and inside, where it is cooled down, and passing into a filter chamber percolates down through charcoal on the one side of centre plate, and up the gravel on the other side, and is run off to ship's tanks. A small test cock is provided so that the man in charge may test the water before it goes to the ship's water tanks. Connection is supplied by steam donkey pump drawing from the sea, the discharge pipe being flanged to worm chamber; the cooling water passing from this chamber enters the dome chamber, when it circulates among the condenser boxes, and is discharged over the ship's side, or coupled to hose and led to any part of the ship. These distillers are made any size, our general sizes being No. 1, to make 12 to 15 gallons per hour; No. 2, to make 25 to 30 gallons per hour; No. 3. to make 40 to 45 gallons per hour; and No 4, to make 80 to 85 gallons per hour. They are passed by the Board of Trade, the allowance being from six pints to one gallon for each person, according to the climate the ship is to trade in.

The firm's general method of fitting the steam winch, boiler, distilling apparatus, donkey, circulating, and feed pumps, in sailing ships was next explained. The steam winch is horizontal geared, with a couple of 6-inch cylinders, on board ship is set on wooden chocks, and bolted to deck, the space between the chokes beneath winch being filled up with cement. The steam is supplied through a main steam pipe, the exhaust being led over ship's side by a malleable iron pipe. The boiler is 8 feet by 4 feet, with two 14-inch solid welded cross tubes, with the usual doors and all mounting complete, inclusive of Government safety valve and Salter's relief valve, pressure gauge, check valve for feed, steam, scum, and blow-down cocks, as also an improved prime preventor, so that it is impossible for any brine to pass into the distiller along with the steam to be condensed. It is provided with a cast-iron sole plate or ash pan bolted to deck and run round with cement, as is also the whole of deck-house floor. The safety valve is arranged to blow off at 45 lb., boiler having been tested to a water-pressure of 100 lb. per square inch. The steam pipe is flanged to the blow-down pipe, which again is flanged to the overflow pipe from the distiller, and discharged over the ship's side. The distilling apparatus in Brown's patent, is guaranteed to make from 40 to 45 gallons per hour fresh water from sea water. The steam to be condensed is conveyed from the boiler through pipes, and admission to distiller regulated by a wheel, and is drawn off as fresh water at a cock, and conveyed to malleable iron tanks through malleable iron pipes. The combined double-action circulating and single action feed steam pump is specially adapted and arranged for the purpose, the water barrels, chambers, valves, &c., being of solid brass; the ram in the circulating pump is $2\frac{3}{4}$ inches diameter and 6 inches stroke, and draws from sea and circulates cooling water through distiller; the plunger of feed pump being $1\frac{1}{4}$ inches diameter and same stroke as the other, being driven by a stud fixed to main piston and ramrod. The cooling water is drawn from sea by a suction pipe, and this pipe is generally led along deck in a covered gutter to fore peak, where it is connected to ship's side by sea cock, and is discharged into distiller through another pipe, and after doing its work overflows over ship's side. A coupling is attached to this last pipe outside of deck-house, so that a hose can be connected and the overflow water used for washing deck or assist in case of fire. The feed is taken by the small pump from the circulating water in distiller, partly warm, and is discharged into boiler; the steam is supplied to donkey by a pipe, and regulated by wheel valve, the exhaust passing into funnel. The extension through the deck-house is provided with warping ends carrying standards and couplings and chain wheels to windlas and ship pumps.

Coming now to the application and working of the foregoing machinery. For loading or discharging cargo at a quay side the fore or main yard of the vessel is braced over the quay at a convenient place, and a block fixed at the yard arm, through which a rope is rove; this is led through a a snatch block to the winding barrel. If a bale is being shipped from the quay it is hoisted above the bulwarks of the vessel by the yard rope. A hatch rope rove through a block suspended between the masts is then hauled taut, and held by one or two turns round a cleat or bitt, the engine slacks off its rope, and the centre of suspension is gradually shifted to the hatch rope, the bale swinging diagonally down and inboard when the man tending the hatch rope lowers the bale into the hold. For discharging cargo the reverse is the action.

Coming to a few details of performances of machine. A boiler, 4 feet 6 inches in diameter, of the return tube type, uses 2 cwt. coal per hour, or one ton per day of ten hours. Beside this should be included $\frac{1}{2}$ cwt. to get up steam and one and a half hour's standing at meal times, or eleven and a half hours in all—second quality Welsh coal being used. The Australian liner, *Ethiopian*, was fitted with such an engine as shown by fig. 3, with a boiler 5 feet by 3 feet 9 inches The coal burnt was at the rate of $2\frac{1}{4}$ cwt. in seven working hours, and in fifty such hours 2000 tons of cargo were shipped. On board another ship in the same line 1800 tons were shipped in forty-seven hours. On the *Yorkshire* 1345 tons of cargo were shipped in fifty-eight working hours. The *Great Victoria* discharged 600 bales of wool in five hours by using a large double-friction winch with cylinders 7 inches in diameter and 10 inches stroke, a boiler 7 feet long by 4 feet 6 inches diameter; the coal burnt was $1\frac{3}{4}$ cwt. per hour. As to cargo weights, a hogshead of sugar weighs 18 cwt., three of these could be lifted at once, and 500 tons could thus be cleared in nine working hours by steam power. In reference to hoisting gear, the rope employed is usually a 3 inch; when all wound up there would be about one and a half layers on the barrel, which, taking the coil round the barrel to be 2 feet on a barrel 3 feet in length, thirty-four coils added to seventeen second coils for the half layer furnishes a total lift of 100 feet. This limit is seldom arrived at in general work, but is useful if a purchase block has to be resorted to, or under other particular circumstances. The heaviest usual load on such a rope is 35 cwt., and this, as in the case of the sugar hogsheads, is sometimes exceeded.

Referring to speeds of machinery, Brown's patent is an illustration, when distilling would work about forty to sixty revolutions per minute, when employed, as is sometimes the case, doing heavy pulling and hauling in setting up rigging or heavy work in working the ship, it would be regulated to run slowly according to requirement. Whilst weighing the anchor it is usually worked very fast, say 150 revolutions; this would rotate the main shaft say 34 times, which would also be the speed of the first motion shaft at the windlass, and it, geering about 5 to 1 with the second motion, would rotate it in round numbers seven times a minutes. This again gearing a pinion to the windlass spur at a ratio of about $3\frac{1}{2}$ to 1, would give it two revolutions a minute. If the ship were anchored in thirty fathoms of water and had out ninety fathoms of cable, the anchor could be brought to the cathead in 30 min. with a windlass of 3 feet in diameter, over the whelps at their largest point, Thus 30 fathoms $= \frac{540}{9 \text{ by } 2} = 30$ min. The speed of the winding barrel of an ordinary winch is from twenty-five to thirty-five revolutions per minute, taking as an example a friction winch having a pair of cylinders 7 inches diameter by 19 inches stroke, pinion diameter or pitch circle 5½, driving a spur 36½ pitch diameter, gives a ratio of about 6¼ to 1; this. at thirty revolutions of the barrel, gives a speed of pinion shaft and cranks of, say, 200 revolutions per minute, though this is often exceeded with light goods. This gives a piston-speed at 1·66 per revolution of 332 feet per minute. Such a winch would have a return tube boiler 7 feet long and 4 feet 6 inches diameter.

Turning now to distillation, allowance of water, &c., the Board of Trade allowance of water, exclusive of that used for cooking, per adults is three quarts per day.* The following is quoted from the regulations of Her Majesty's transport service, to be observed in respect of all ships employed by the Admiralty as transports, hired troopships, troop freight ships, convict ships, or store ships:—"1st June, 1866.—Minimum allowance of distilled or filtered water per day per individual, inclusive of oven, six pints out of the tropics, and one gallon within them. To officers for all purposes. Referring to the expense of fuel for distillation the following may be given:—In one case 30 gallons an hour, or 300 in ten hours, was produced by the consumption of 4 cwt. of coal, equalling about 7 lb. of water evaporated per pound of coal, though it must be observed that allowance for a second-class coal on the one hand and the improbability of the amount of distilled water being anything like a close test of evaporation on the other, a higher evaporative result might have been actually obtained, but the author only gives the figures as quoted from his own notes supplied by authorities who had worked distillers at sea. In another instance 3½ cwt. of Welsh coal distilled 350 gallons of water. Then, again, on board an Australian liner the production of water per day on the voyage to Melbourne was 1600 gallons, from thence to China 1800 gallons, voyage home 1400 gallons. The foregoing data coupled with the fact that ships having a duly certified distilling apparatus on board can sail with only one-half the quantity of fresh water on board otherwise required by the Board of Trade which is stored in tanks containing usually 300 gallons each. This will enable those interested to judge for themselves of the economy of fitting a ship with a distilling apparatus.

The author, in concluding his paper, will just direct attention to two points. The first is that although a small and portable apparatus for distilling water and heated by some cheap mineral oil would often be a means of saving life in cases of disaster at sea, if fitted in a ship's life or other boat, he is not aware that any such has ever been constructed, nor has the thing apparently attracted any attention; the only person who ever discussed the question with him being the Rev. Mr. Berthon, inventor of the collapsing life-boat. The second point the author would refer to as follows:—All engaged in the Australian trade are often put to delay, owing to what is called the calm belt of from three to twenty miles, situate between the northern and the southern trade winds; often here a ship that has made before a rapid progress loses days waiting for any slant of wind to take her out of this region of calm. The author has heard of two liners in sight of each other at this belt for more than a day both becalmed, when one got a lucky whiff that took her to the next trade, while the other was left for two days after her. The author believes efforts have been from time to time made to utilise the steam winch or distilling engine in some way to move the ship on, and he himself designed an engine that could be disconnected from the distiller, and, with its boiler, be placed in a boat and sent ahead to tow.

INSTITUTION OF CIVIL ENGINEERS.

At the meeting on Tuesday, the 13th April, Mr. W. H. Barlow, F.R.S., president, in the chair, the first paper read was on the "Abingdon Sewerage," by Mr. Charles Foote Gower, M. Inst. C.E.

Being under notice to desist from any longer discharging the sewage of their town into the river Thames, the authorities of Abingdon called upon Mr. Bailey Denton, M. Inst. C.E., in the year 1874, to advise them as to the best means of dealing with the sewage, so as to satisfy the requirements of the Thames Conservators. Mr. Denton having, with the assistance of the author, made an inspection of the town and neighbourhood, recommended that twenty acres of land should be acquired, for the purpose of cleansing the sewage by intermittent filtration, and gave at the same time a general description of the necessary sewers, pumping stations, and other works since carried out.

The population of Abingdon was about 6000; but provision had been made, in the construction of the works, for at least 10,000 persons. The normal flow of sewage, when undiluted, was taken at 250,000 gallons per day. The ordinary level of the Thames at Abingdon was 162 feet above Ordnance datum. In flood time it reached nearly 167 feet. The River Ock was kept up for the purpose of working mills at a level of 168 feet. The surface levels in the streets of the town varied from about 170 to 200 feet above Ordnance datum. The subsoil water in that part of the town contiguous to the Thames accorded pretty nearly with the river level, 162 feet; but in other parts of the town, previous to the carrying out of the sewerage works, it was regulated by the level of the Ock Mill Stream, and the consequence was that it sometimes rose, in wet seasons, almost to the level of the streets, and proved injurious to the health of the inhabitants. The sewers in Abingdon were formerly very inadequate for the duty required of them; they had been retained, however, in connection with the street gulleys, to carry off rain water from the streets. The level of the land selected for the purification and utilisation of the sewage varied from 165 to 168 feet above Ordnance datum. From the general surface height, and contour of the town, it was impracticable to bring the sewage on to this land without lifting it from 10 to 20 feet from the invert outfall sewer. In the design for the new sewers no rain-water was to be admitted except from back yards, roofs and other surfaces, from which it could not economically be kept out. Having regard to the purification of the sewage, and the necessity for pumping, every precaution was therefore taken to keep the quantity to be dealt with within definite limits. The level of the subsoil water in Ock Street and other places had been reduced by laying separate drains, open jointed, beneath or contiguous to the sewers.

In laying the sewers the joints were caulked with tarred gasket and cement, and in some cases were bedded and surrounded with concrete, or clay puddle, to prevent the ingress of subsoil water or the escape of the sewage into the surrounding soil. Meanwhile, the town having been without a public water supply, arrangements were made for flushing the sewers by inlets from the river, and from other sources. The main outfall sewer from the town was 18 inches in diameter, and was capable of discharging 2,000,000 gallons in twenty-four hours, being eight times the estimated dry-weather flow of sewage. The secondary sewers in the town consisted of 15-inch, 12-inch, and 9-inch pipes. The lower portion of the outfall sewer was 3 feet 6 inches in diameter, and served as a reservoir to hold the night flow of sewage, in connection with the pumping station. This sewer was at times subject to considerable internal pressure from the sewage collected in it, as well as to external pressure from the subsoil water outside being 8 feet below the ordinary level of the Thames. Each engine could pump 400 gallons of sewage per minute; thus both engines working together would lift above 1,000,000 gallons per day. In connection with the engines, a storm overflow from the pumping reservoir had been provided, to relieve the latter in case of heavy storms, floods, or accidents to the engines; upwards of 100,000 gallons must flow into the reservoir before any overflow could take place. This provision was more than enough for the night-flow of sewage, if the reservoir was pumped empty at the close of the day. The cost of the sewerage of the town had been £8750, including a portion of the charge for private connecting sewers, which were executed by the contractor for the main sewers up to the boundaries of private properties on each side of the street. The cost of the engines and pumping station, including fencing of yard, weighing machine and sewage screens, had been £2500, of which sum the engines cost about £800. The annual cost of pumping for the last two years had not exceeded £150; but with an increase of water supply it would probably be somewhat greater. The area of land acquired by the Corporation of Abingdon was more than double what Mr. Denton at first proposed. The farm, with cottage and buildings, was let at an annual rental of £4 10s. per acre, the Corporation pumping the sewage. The works were practically completed in 1877, and from that time, with but little exception, the Thames had been free from Abingdon sewage; the land first received it, and after passing through the soil, the effluent water flowed into the river. Samples of the effluent were found by analysis to be better in quality than the water of many of the wells in use in the town. The sewers were freely ventilated throughout the town by shafts, which were also used for inspection and for flushing. The latter operation had to be put into force at least twice a week, owing to the comparatively sluggish flow, the amount of water used for domestic purposes being very small.

The second paper read was on "The Main Drainage of Torquay," by Mr. George Chatterton, M.A., Assoc. M. Inst. C.E.

The author stated that Torquay, on the northern shore of Torbay, had a population of about 30,000. Previous to 1878 the sewage of the town was discharged into the bay by three outfalls, and was a nuisance at low water and in hot weather. The main sewers were constantly closed at their outlets by the sea, which at high water flowed up a considerable way into the town; many of them were of insufficient capacity, and the ventilation being defective, foul gases were driven into the houses. The scheme described was designed and carried out by Sir. J. W. Bazalgette, C.B., V.P. Inst. C.E. Its main features were a high and a low level system of sewers. The high-level sewer commenced near Tor Abbey, and had an outfall at Hope's Nose, the eastern extremity of Torbay. The set of the tide at the point of outfall was from the bay at all times, and at present no sewage could enter the bay. The total length of the high-level sewer was 17,030 feet, and it was 7 feet in diameter for a length of 11,387 feet; the fall was 1 in 1177; the level of the invert at the outfall was 4·16 feet below high water of spring tides. The quantity of water brought into the town daily was 600,000 gallons; the dry-weather flow of the sewers was about 1,250,000 gallons, the difference being caused by the streams, springs, and overflow of wells, which had been taken into the sewers. In constructing the high-level sewer, it was necessary to drive three tunnels—at Waldon Hill, Meadfoot Hill, and Kilmorie Hill respectively. The Waldon Hill tunnel was in Devonian limestone; it was 1150 feet long, the size being 5 feet 6 inches by 4 feet; it was driven from two open faces, the average progress was 9·12 lineal feet per week from each face; hand labour alone was employed, and the invert portion was lined with Portland cement concrete. The cost of the sewer completed was £1 16s. per lineal foot. The Meadfoot tunnel was 4458 feet long: the sewer was 7 feet in diameter. This tunnel was in limestone rock for the greater part of its length, but some of it was in soft ground. Hand labour alone was employed, it was driven from four working shafts; the average progress per week from each face was about 15 feet. Where the ground was limestone it was lined with Portland cement concrete 9 inches thick, while the sewer in soft ground was formed of brickwork. The average cost per lineal foot for driving this tunnel wes £1 9s., and the total cost of completed sewer, £2 10s. per lineal foot.

A new roadway and sea-wall were constructed along the Meadfoot beach, with the sewer under the road. The sewer consisted of a single ring of brickwork surrounded with, and founded upon, lias lime concrete carried down to the solid rock. The sea-wall was 1900 feet long, and was built of random-coursed limestone masonry, backed with rubble. The Kilmorie Hill tunnel was 4564 feet long. The nature of the rock varied greatly; in some places it was an argillaceous siliceous grit, with bands of pure quartz, and extremely hard; in other places it was of a shaly composition, while near the outfall it was limestone. The advance per week by hand labour was so slow that it was found necessary to introduce rock-boring machinery at the open face and at one shaft. The progress in feet per week was increased by using rock-boring machinery at the open face in the ratio of 2·33 to 1, and at the shaft in the ratio of 2·19 to 1. The cost per lineal foot was also increased, but not in a corresponding ratio. Ingersoll rock-drills were used, and the air was compressed by Sturgeon's high-speed air-compressors. Dynamite was found to be the most effective and economical explosive; 11 tons of it were used without a single accident. There were thirteen ventilating shafts on the high-level sewer. The flow of sewage was continuous, so that sewer gas was not generated to anything like the same extent as in tank sewers. There had been no deposit in the sewer. The low-level system received the sewage of about one-tenth of the population of Torquay. The total length was 5184 feet. Surface-water was kept out of this system as far as possible. The low-level sewage was lifted about 15 feet by a water-pressure engine, with pumps in duplicate. The pumps were worked by a head of 250 feet of water from the town main, and required no superintendence.

A contract for the construction of the works was entered into in 1875, but in January, 1876, the contractors suspended operations, having executed work to the value of about £8000. On receiving fresh tenders the Local Board became alarmed; the lowest tender was £75,000. and this did not include the cost of extra work and other items, which would have involved a total outlay of £103,327, while the engineer's estimate for the same amounted to only £65,000. Under these circumstances, the Local Board, acting under the advice of Sir J. W. Bazalgette,* determined not to accept any tender, but to execute the works themselves by administration. Mr. G. Phillips was appointed resident engineer, and the whole scheme was completed by August, 1878, or or in two years and five months from the commencement of operations by the Local Board. The total cost of the scheme to the Local Board was £66,145, a saving to the town of £37,182 by not accepting the lowest tender. The cost of the Kilmorie tunnel was £14,358, or £3 2s. 11d. per lineal foot. Of this amount, the cost of the driving was 74·53 per cent., of the trimming 15·98 per cent., and of the lining 9·49 per cent. The rock-boring machinery cost £1395. The execution of the works had involved a rate of about sevenpence in the pound on the present rateable value.

At the meeting of the Institution on Tuesday evening, M. de Lesseps was proposed by the Council for election as an honorary member, on account of the eminent services rendered by him to the science and practice of engineering by the conception and successful prosecution, under many difficulties, of the design of uniting the Mediterranean with the Red Sea by the Suez Canal—declared to be, in the form of recommendation, "one of the grandest and most important public works of modern times." At the moment when this proposal was submitted to the meeting, and had been approved by acclamation, M. de Lesseps entered the room, and was very cordially received. Subsequently, during the sitting, he addressed the meeting in French, and observed that the soundings and levels for the Panama Canal had been made, and the conclusion he had arrived at, during a sojourn of sixty days in America was, that the canal enterprise was feasible. In this opinion he was supported by American engineers of standing in all the principal cities of the Union. The Americans possessed great practical sense, and the assumption was warranted that in this matter the interest of the community would rise superior to the promptings of the Monroe doctrine. For himself, he was an engineer, not a diplomatist. In some respects the Panama Canal would be easier of execution than that of Suez, but the present was not the occasion to enter into details. The Institution would best judge the merits of the proposed mode of working from the discussion at San Francisco, between the American Society of Engineers and the Chamber of Commerce, of which he presented a copy, together with other documents. He hoped, at a future time, to explain his views at greater length.

The Institution of Civil Engineers.—At the meeting of the Institution on Tuesday the 6th April, Mr. W. H. Barlow, F.R.S., President, in the Chair, it was announced that the Council had recently transferred Messrs. W. Adams, F. J. Johnstone, J. L. F. Target, A. W. N. Tyrrell, and E. Wilson, to the class of *Members*; and had admitted Messrs. H. Bird, J. Briggs, W. Coles, E. Chambers, J. Devis, R. P. Fleming, O. H. Harrison, F. F. Miller, H. B. Pyne, J. C. Shears, A. H. Shield, E. Stables, W. J. Storey, and W. P. Turnbull, as *Students*. The monthly ballot resulted in the election of six *Members*, viz.—Messrs. R. Bailie, London Yard, Isle of Dogs; W. F. Batho, Westminster; J. Dillon, Dublin; C. H. L. Kühl, Resident Engineer, European Commission of the Danube; C. Y. O'Connor, Hokitika, N. Z.; and A. Sopwith, Cannock Chase Collieries; of sixteen *Associate Members*, viz.—Messrs. R. F. Alford, Westminster; J. Allsopp, Engineer to the Local Board of Walsall; A. E. Baldwin, Stud. Inst. C.E., Dock Works, Milford; W. Belton, Engineer and Manager of the Shrewsbury Gas Works; P. H. Brown, late of the Indian P.W.D.; C. G. Clarke, Hull; W. Cooper, Superintending Engineer, P. and O. S. N. Co., Bombay; Rodolph Fane De Salis, B.A., Westminster; J. T. Earnshaw, Borough Surveyer, Ashton-under-Lyne; C. J. Grierson, Stud. Inst. C.E., Joint Railway Office, Birkenhead; W. H. Jones, Stud. Inst. C.E., G. W. Railway, Reading; E. T. Lang, late of the Indian P.W.D.; A. H. V. Newton, Assisarnt Municipal Engineer of Singapore; I. Spielman, Stud. Inst. D.E.. Westbourne Terrace; W. M. Vivian, Resident Engineer to H.H. the Rajah of Chumba (Punjab); and G. Wade, Brixton. Mr. R. Anderson, of Messrs. R. S. Newall and Co., was made an *Associate*.

Midland Institute of Mining Engineers.—On Wednesday the members of this Institute had a banquet at the King's Head Hotel, Barnsley, which was largely attended. After dinner a public meeting was held under the presidency of R. Carter, Esq., C.E.F.G.S., president of the Institute, Mr. R. Miller, vice-chair. The usual loyal and constitutional toasts having been given from the chair, Professor Green proposed success to the mining interests of the country and the coal trade generally. Mr. Embleton, in replying to the toast, said they had been told that the mining engineers in this part of the country were not mining engineers at all; in fact, the want of science in the Barnsley district had been the cause of all those dreadful explosions which had happened here. This was what they were told. They were told they could go to Nottinghamshire where there was no gas at all, where there was no difficulty of that kind—they were told that if the Barnsley engineers were removed there, great loss of life would take place. He hoped those eminent engineers from Nottinghamshire would come and try themselves in the Barnsley district for fifty years as he had tried, and if they could prevent what had hitherto happened it would be a happy thing for this county and for the neighbourhood. The Nottinghamshire hard coal, which was equivalent to the hard coal in the Barnsley district, was as different from it as light from darkness. They had no gas in Nottinghamshire coal, and any mining engineer could manage if he was not troubled with gas. He then instanced the manner in which outbursts of gas occurred in the Barnsley district. At the Oaks Colliery, with a current of 140,000 feet of air per minute, an outburst occurred which fired at the bottom of the upcast. Had there been anything different a terrible explosion must have taken place. Had they worked without lamps, as in Nottinghamshire, an explosion would have been inevitable. He instanced other cases. Other toasts connected with the trade and with scientific subjects were afterwards drunk and responded to.

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* 18 and 19 Vic., cap. 119.

Manchester Scientific and Mechanical Society.—At the ordinary meeting of the above Society, held on Friday evening, Mr. I. Bowes, the President, in the chair, a paper on "Chimneys: their Use and Abuse," was read by Mr. G. E. Davis. After giving a description of some of the principal chimneys in the kingdom, the writer urged that the legitimate use of chimneys was to carry off clean gases free from acidity, and he considered they were greatly abused when they sent out black smoke and noxious gases. He did not think that the temperature of gases, especially in metallurgical works, should be allowed to interfere with their condensation, seeing that in chemical works manufacturers were now compelled by law to condense gases which were at a bright red heat. With regard to the speed of draughts in tall chimneys, he considered that most of the formulæ given by authors were wrong, as the results worked out were all different. The disposal of smoke by what was termed smoke-washing was a very expensive operation, because it would cost a man who burned ten tons of coal a week about £120 per year for soda-ash, with which to neutralise the ill-effects of the sulphur; and he urged that by the use of mechanical stokers, or by very careful hand-firing, the smoke nuisance could be fully got rid off. A short discussion followed, and the usual vote of thanks was passed to the reader of the paper.

The London Association of Foremen Engineers and Draughtsmen.—The twenty-seventh anniversary dinner of this institution was held on Saturday at the Cannon Street Hotel, when the chair was occupied by the Lord Mayor. About 250 sat down to dinner, among whom were the Earl of Aberdeen, General Cavanagh, Mr. Lawrence, M.P., Mr. Sheriff Woolloton, Captain C. E. Foot, Lieut. Maclure, Mr. Joseph Newton, the president of the association and others. The association, which was founded in 1852, now numbers 329 members. Its object is to promote scientific investigation in relation to engineering, and to carry out its purpose papers of a practical character, dealing with scientific subjects, are read at its monthly meetings. In connection with the institution are a superannuation fund and a widow and orphan fund. The usual loyal toasts having been duly honoured, Captain C. E. Foot, R.N., in responding for the navy, thanked the engineers who had applied machinery to the propulsion and steering of ships, to the working of the enormous guns now put on board of them, and to the weighing of their anchors. The chairman, in proposing the toast of the evening, "Prosperity to the Association," hoped that its members would reap the benefit of the reviving prosperity of trade. Steam and gas had already done much for the community, and it was impossible to predict what electricity, which had already given us the electric telegraph, the telephone, and the phonograph, would do for us in the future. He coupled the toast with the name of Mr. J. Newton, who had been the president of the institution for the last twenty-five years. Mr. J. Newton, in responding, referred to the progress that the institution had made during the time he had had the honour of being its president. It was at first regarded with a very jealous eye by employers, who feared that it might grow into a vast system of superior trades unionism. Thanks, however, to time and to the real principles of the association becoming more generally known, employers were now among its most stanch supporters. The institution had largely tended to raise the intellectual and social standard of its members and to make them better foremen and better citizens. From a benevolent point of view, also, the institution had done much good. During the period of depression, from which we were now happily emerging, its funds had kept the wolf from the door in numerous instances, and in time of urgent need they had been of the greatest assistance to the widows and orphans of members.

International Fisheries Exhibition.—An international exhibition of boats, nets, tackle, and all other matter pertaining to fisheries will be held in the spring of next year in the fishing village of Scheveningen. The Chevalier Teding van Berkhout, of Amsterdam, is chairman of the committee for programmes and catalogues.

Sir H. Bessemer.—Sir Henry Bessemer, F.R.S., and M. Inst. C.E., was yesterday presented with the freedom and livery of the Worshipful Company of Turners. The honour was, in terms of the resolution conveying it, bestowed "in recognition of the great services which the recipient has rendered to the world by the invention and production of Bessemer steel."

Technical Education.—The Goldsmiths' Company are about to make an annual grant of £300 for three years in order to provide suitable practical and technical instruction at the Horological Institute for apprentices and improvers; and the City guilds are also subscribing a sum of £500 as a donation, with a promise of more if the result be satisfactory.—*City Press.*

Gold in Northern Russia.—A number of years ago an escaped criminal from Siberia discovered in the neighbourhood of Schenkursh, in the provinces of Archangel, sand-beds containing a large quantity of gold. He kept his discovery a secret, and only made it known last year on his death bed. A company for working the beds is already formed, and is at present endeavouring to obtain the concession.

Telegraphy in China.—Notice has been received at the Hydrographic Office from the Chinese Government that two telegraph cables have been laid down at Taku at the entrance to the Peiho river. The first of these cables connects the upper corner of Taku south fort with the lower corner of the north fort; the other connecting the China Merchants Steam Navigation Company's landing pier with the north bank of the river. Vessels are cautioned not to anchor near the cables, the locality of which will be indicated by beacons.

An Imperial Prize.—Last week an "aquarium" was exhibited at Munich, which has been manufactured by command of the German Emperor, and is intended for the first prize at the approaching fishery exhibition at Berlin. It consists of a large glass sphere, supported by three Naiads. The space between the figures is filled with flowers. The stand on which the the whole rests is of hammered ironwork. Dolphins and sea-plants wrought in copper are entwined in the work. The work was designed by Professor von Miller, and is pronounced to be a beautiful piece of art.

Technical Education for Idiots.—The special school for idiots which has been in existence at the Hague for now just a quarter of a century points, in its annual report, to very cheering results. From May, 1855, till March, 1880, the register of the Hague School for Idiots has borne the names of 417 pupils, of whom 148 were boarding out. Of the entire number 43 have gone directly into service or adopted a regular trade, while 25, greatly restored to health, have been discharged from the institution. The school as at present 64 pupils, of whom 43 are boarders but the total number of minor idiots in Holland is estimated at 3000, one-third of whom are held to be capable of education.

The Telephone.—On Thursday, last week, a large number of gentlemen interested in mining operations visited the Carberry coalpit, near Musselburgh, on the invitation of Lord Elphinstone, with the view of witnessing an experiment for communicating from the interior of the pit to the surface by means of the telephone. After an explanation by Mr. Charlton Wollaston, C.E., of the General Telephone Agency Company (Limited), the company descended the shaft, and were entertained at luncheon, provided by Lord Elphinstone. In the course of the luncheon several airs were played by a band at the outside end of the telephone, and the music was distinctly heard in the colliery.

Fall of Meteoric Dust.—Professor Silvestria, of the Catania Observatory, reports the fall on the night of the 29th of March of a shower of meteoric dust, mingled with rain. Besides the usual characteristics of colour, chemical composition, and the mixture of mineral and organic particles and minute infusoria, there was a considerable proportion of iron, either in a purely metallic state or in metallic particles, coated with oxide. The size varied from a tenth to a hundredth part of a millimèter, and the form was either irregular or spherical, as if it had undergone fusion. This phenomenon was first observed in the Indian Ocean, south of Java, in 1859, and has been corroborated by Professor Nordenskjöld's Arctic observations.

Austrian Petroleum Beds.—A considerable industry exists in the province of Galicia in the shape of petroleum wells, though its value is much depreciated by the difficulty of transportation, the nearest railway station being thirty miles distant. The petroleum field is some 400 miles long by forty wide, extending from the north-west at Klenyzany to Remairi, in the south-east, and across the Carpathian Mountains to Jaslo. The most westerly of the districts in work produces about 400 barrels of oil per day, the wells varying from 500 feet to 800 feet, and the oil being refined on the spot. The other districts are very fluctuating in their yield. The Galician wells, however, produce a kind of wax called ozokerit, which is known to English housekeepers in connection with candles.

Iron and Steel Institute.—The *Cologne Gazette* states that a committee, consisting of representatives of the German industrial establishments which tendered an invitation to the Iron and Steel Institute to hold its annual meeting this year in Düsseldorf, is already busily engaged in making preparations for the entertainment of the visitors. The reception will formally begin on August 25th. The two following days will be devoted to discussions, the inspection of special exhibitions, and visits to various industrial establishments and mines in the Rhenish Westphalian district. On August 29th there is to be an excursion by special train up the Rhine Valley to Bingen, returning by steamer to Cologne. Our Cologne contemporary says that the promised gathering of English and German iron and steel manufacturers on German gronnd will attract a very large share of attention; and expresses a hope that the efforts of the committee will be responded to by the local authorities and others in the neighbourhood of Düsseldorf, who are interested, in a manner worthy of the occasion.

Mr. Edison as a Real Alchemist.—Mr. Edison's latest discovery bids fair to eclipse any that he has yet made if the accounts given of it by the American papers prove correct. He has, it is stated, invented methods by which he can extract a greater amount of gold from the rejected residum of auriferous quartz, termed by miners "tailings," than is obtained by the present processes from the virgin rocks triturated by the crushing mills. The agents he employs are chemistry and electricity. He takes a quantity of "tailings," which, so far as any known process is concerned, contains not a trace of gold, and produces therefrom the precious metal in quantities truly astonishing. He says that by his method he has got out gold from concentrated "tailings" at the enormous ratio in some instances of 1400 dols. per ton, at an expense not exceeding five dollars per ton. This discovery was made by him while endeavouring to find a supply of platinum for his electric lamps. In the course of experiments made by him with the view of inventing a process for the cheap extraction of this metal from the "tailings" of some California gold mines, specimens of which had been sent him, he was surprised at the large amount of gold existing in the rejected residue of the mines. This gave his researches a new direction. The electric light came to be a secondary consideration. He devoted his energies to the fresh discovery, and the success of his process was at last evident beyond a doubt. Keeping the secret to himself and to a few confidential agents, he at once made contracts for the "tailings" of a number of the largest mines for a term of years. He has thus secured millions of tons of "tailings," and if his manipulations of the refuse really prove as valuable as stated, Mr. Edison ought to become a "veritable Crœsus."

MEETINGS FOR THE WEEK.

MONDAY, April 19.

Royal Institute of British Architects.—8 p.m. 1. Mr. J. A Picton, on Iron as a Material for Architectural Construction. 2. Mr. W. A. B. Kennedy, on Steel.

Society of Arts.—8 p.m. Cantor Lecture. Mr. R. W. Edis, on Art Decoration and Furniture. Ancient and Modern. Constructive Furniture, Mantelpieces, Fireplaces, Fenders, Window Seats, &c.

Royal United Service Institution.—8.30 p.m. Major W. Geddes, on Manual Transport.

TUESDAY, April 20.

Royal Institution.—3 p.m. Mr. R. H. Scott, on Wind and Weather.

Trinity College, London.—8 p.m. Free Lecture. Rev. W. H. A. Emra, on Physical Education.

Royal Colonial Society.—8 p.m. Sir Anthony Musgrave, on Jamaica.

Institution of Civil Engineers.—8 p.m. Discussion on Abingdon Sewerage and Torquay Main Drainage; and time permitting, Mr. H. Hayter, on the Amsterdam Ship Canal.

Statistical Society.—7.45 p.m. Dr. F. J. Mouat, F.R.C.S., on the Education and Training of Children of the Poor.

Gresham Hall Lecture.—6 p.m. The Very Rev. Prof. Cowie, on Geometry. (Free).

WEDNESDAY, April 21.

Meteorological Society.—7 p.m.

British Archæological Association.—8 p.m. 1. Rev. Dr. Ridding and the Rev. C. Collier, on Recent Discoveries at Wolvesley Castle. 2. Mr. H. Syer Cuming, on the Martel de Fer, or War Hammer.

Royal United Service Institution.—3 p.m. Professor Vambéry, on the Past and Future of the Turcomans.

Society of Arts.—8 p.m. Mr. W. Holman Hunt, on the Present System of Obtaining Materials in use by Artist Painters, as compared with that of the Old Masters. The discussion will be opened by Sir Coutts Lindsay, Bart.

Gresham Hall Lecture.—6 p.m. The Very Rev. Prof. Cowie, on Geometry.

THURSDAY, April 22.

Royal Institution.—3 p.m. Professor Tyndall, on Light as a Mode of Motion. Colours.

Royal Society Club.—6.30 p.m.

Inventors' Institute.—8.15 p.m.

Society for Encouragement of the Fine Arts.—8 p.m. Conversazione.

Civil and Mechanical Engineers' Society.—7 p.m. Mr. C. H Rew, on Roof Construction in the Middle Ages.

Hunterian Society.—8 p.m.

Royal Society.—4.30 p.m.

Society of Arts.—8 p.m. Section of Applied Chemistry and Physics. Captain Abney, on Some Recent Advances in the Science of Photography.

Gresham Hall Lecture.—6 p.m. The Very Rev. Prof. Cowie, on Geometry.

FRIDAY, April 23.

Architectural Association.—7.30 p.m. Messrs. T. Rogers Smith and R. E. Smith, on Haddon Hall, Derbyshire.

City of London College.—6 p.m. Dr. Heinemann on Political Economy. The Leading Writers in England and on the Continent of the 18th Century. (With discussion).

Quekett Microscopical Club.—8 p.m. 1. Mr. J. G. Waller, on an Undescribed British Sponge of the Genus *Raphiodesma*. 2. Mr. A. Martinelli, on the Mechanism of the Stomata of the Holly.

Royal Institution.—8 p.m. Weekly Meeting. 9 p.m. Mr. Walter Pollock, on Dumas père.

SATURDAY, April 24.

Royal Institution.—3 p.m. Mr. James Sully, on Art and Vision.

Physical Society.—3 p.m.

Geologists' Association.—9.30 a.m. Excursion to Camberley and Easthampstead Heath. Flint Implements, Upper, Middle and Lower Bagshot Sands.

RAILWAYS & TRAMWAYS.

Railway Extension in the West Riding.—A new and important loop line on the Great Northern Railway was opened on Monday last for passenger service. The manufacturing towns of Dewsbury and Batley have just been connected by a line that runs parallel with the London and North-Western Railway, and intersects it twice between the two towns, distant about a mile. The service between Bradford and Wakefield is now conducted via Dewsbury, instead of, as before, by Batley only, though there is already an alternative route between Bradford and Wakefield.

The Tay Bridge Disaster.—On Friday night, last week, the engine of the train engulfed when the Tay Bridge fell was successfully raised. It wants the funnel, but otherwise is little damaged. As yet it has not been minutely examined, but it is clear that the reverse action had not been applied, and the supposition is that the driver had had no time to put on the brakes or in any way to interfere with the speed of the train. The inquiry into the causes of this disaster is to be resumed on Monday next, the 19th inst., in Westminster Hall, when scientific evidence will be taken.

Railway Extension in the United States.—The Philadelphia correspondent of the *The Times* writes:—"Railway construction in the United States recently took a fresh start, and this is providing our working classes with a great deal of additional labour. Since September 1st it is estimated that 3000 miles of new railway have been constructed, while over 12,000 miles of additional line are projected and to be built during the year. These enterprises will absorb about 273,000,000 dollars new capital, thus giving an enormous impetus to the many trades that are interested."

The Severn Tunnel.—The works in connection with the construction of the tunnel under the Severn at Portskenet have been recommenced, and are now being carried on with great vigour. The company have obtained the required ground, and Mr. Walker, who is now the contractor for the execution of the whole of the scheme, has commenced to sink three new shafts—one near the original shaft on the side of the Severn, and two others near the spot where the spring was struck which flooded the works some months since. At these shafts there will be large and powerful engines fixed, the intention of the engineers being to allow the water to continue running into the works and pump it out, and not to try to drive it back, as it was at first attempted. Mr. Walker is erecting large sheds and kilns for brick-making on the premises, and there is every appearance of a determined effort on the part of all concerned, and every probability of final and complete success in this gigantic yet most desirable undertaking.

The St. Gothard Tunnel.—*The Times* Geneva correspondent writes, under the date April 5th.—M. Stapff, a scientific member of the St. Gothard engineering staff, writes to the *Journal de Genève* to correct certain theories touching the variations of the air-currents in the great tunnel and their causes, which have recently been going the round of the Continental press. The direction of the current through the tunnel, he says, of which the south portal is 36 metres higher than the north portal, is determined by two causes. The first is the difference between the weight of a column of air 36 feet high, at the temperature of the interior, and the weight of a similar column at the temperature of the outside of the tunnel. If the outside temperature were always lower than that of the inside, if there were no points of resistance, if the barometric pressure were always equal on both sides of the mountain, then the draught would always tend from north to south. The second cause is the difference in the barometric pressure on the two slopes of the mountain. If the barometer be higher on the north than the south, the current will be from north to south, and *vice versa*. Thus the barometric pressure may increase, or neutralise, or diminish the current determined by the first cause. The most essential "resistances" that modify the full effect of these two forces are:—(1) the counter-pressure of the air, which in passing through the tunnel is heated and expanded; (2) the friction of the rocks and other fixed objects. These four factors (and a few others of minor importance) taken together, determine the direction and the speed of the current during a given period. All are variable, even the resistance opposed by the friction of fixed objects. In order to ascertain the relation to each other of these four variable conditions and the draught, it was necessary to make a series of direct observations in different circumstances. The meteorological observations which have been regularly made during the construction of the tunnel at Airolo and Goeschenen furnish the statistics necessary to find out the number of days (in a month or a year) during which a current from north or south or a complete calm may be expected to prevail; and the calculation of probabilities much on this basis will be utilised in the contemplated arrangements for the ventilation of the completed tunnel. M. Stapff then goes on to say that he has been occupied in studying the phenomena connected with the movements of the air in the tunnel for a considerable time, and that he made many observations on the day of the opening, February 29th, a full account of which he has transmitted to the head quarters of the St. Gothard Railway and Central Meteorological Bureau, at Zurich. He says, further, that on the day in question the barometer was higher at Goeschenen than at Airolo, the draught from north to south, and that in the little gallery (that on the Airolo side) the current immediately before the finish was at the rate of 0·15 metres per second. After the joining of the two galleries the current between 1 and 1.15 p.m. was at the rate per second of 0·24 metres; between 1.45 and 2, 0·53; between 2 and 2.30, 1·2; at 3.20, 1·6; 4.25, 0·91; 4.55, 0·46; and 5.20, 0·0 metres; at 5.25 the draught, at the rate of 0·27 metres, was from south to north; and at 6 o'clock it was still from south to north. During this time the barometer at Goeschenen had fallen, and that at Airolo had risen. At 6 o'clock the observations, which were made at Goeschenen at a point 3000 metres, and at Airolo at a point 2070·5 metres above the level of the sea, were discontinued. The New York *Tribune* says that when M. Favre, the architect of the tunnel, began operations at St. Gothard, he was a lively, companionable man of joyous temperament, with jet black hair and beard. The unforeseen difficulties of the work, the unlooked-for hardness of the rock in the mountain and the financial embarassments of the undertaking, soon whitened his hair and changed him into an absorbed and care-worn man. The tunnel was his executioner. He met his death within its gloomy depths. Fate denied him the triumph of witnessing the success of his work. His workmen wanted to cut for him a tomb in the heart of the mountain, and thus give him a monument mightier than the Pyramids of the Pharaohs, but their request was denied by Favre's relatives.

NAVAL ARCHITECTURE.

THE CLYDE SHIPBUILDING TRADE FOR MARCH.

During the month of March there has been considerable activity in the launching of vessels from the building yards on the Clyde, and the departments engaged in the later stages of ship construction have been fairly well employed. The amount of tonnage completed all over the river amounted to 17,567 tons, and though this falls short of the returns for some of the preceding periods, it is nevertheless a satisfactory amount of work. The vessels launched comprised eleven screw-steamers, one paddle-steamer, one tug, one war vessel, one iron sailing ship, one yacht, one ferry boat, and a schooner—total, eighteen vessels. The value of these figures will be seen by comparing them with those for the corresponding month in former years. In February last the returns amounted to 15,874 tons; in March, 1879, to 22,753 tons; in March, 1878, to 27,850 tons; in March, 1877, to 15,570 tons; in March, 1876, 10,800 tons; in March, 1875, to 15,500 tons; and in March 1874, they amounted to 32,000 tons. The position of the trade is in precisely the same position as it was at the date of last report. The amount of work on hand is large, inquiries are pretty numerous, and orders are being secured. A considerable amount of new tonnage was booked during the past month, and the trade is in a fairly healthy state. Messrs. John Elder and Co., launched a war vessel for the Government, while Messrs. A. and J. Inglis launched the first of the eight vessels presently being constructed by Clyde firms for the Compagnie Générale Transatlantique. In the upper reaches of the river, which include Govan, Partick, Whiteinch, Dalmuir, Renfrew and Dumbarton, there were launched during the month fourteen vessels of an aggregate tonnage of 15,137 tons, as compared with twelve vessels and 15,174 tons during the previous month. The following are the details:—Messrs. John Elder and Co., Govan, launched H.M.S. *Niger*, a composite paddle-wheel steam vessel for carrying despatches; the displacement being 954 tons. Messrs. Elder and Co. also launched the *Prins Hendrik*, a paddle steamer of 1652 tons, for the mail and passenger service of the Stoomvaart Waatschappij Zeeland, Amsterdam. Messrs. William Denny and Brothers, Dumbarton, launched the *Plucky*, an iron screw tug of 95 tons, for the Otago Towing Company, New Zealand. Messrs. Denny and Brothers, also launched the *Ravenna*, a steamer of 3200 tons, for the P. and O. Steam Navigation Company. Messrs. Barclay, Curle and Co., Whiteinch, launched the *Argo*, an iron sailing ship of 1500 tons, for Messrs. A. and J. H. Carmichael, Greenock. Messrs. Barr and Shearer, Ardrossan, launched the *Willie Glen*, a three-masted schooner of 260 tons for Messrs. Glen and Robertson, and intended for the Newfoundland trade. Messrs. A. and J. Inglis, Pointhouse, launched the *Charles Quint*, a screw-steamer of 2000 tons and 2000 indicated horse-power for the mail and passenger service of the Compagnie Générale Transatlantique. Messrs. Napier, Shanks and Bell, Yoker, launched the *Soto*, a steamer of 950 tons, built to the order of Messrs. Robert MacAndrew and Co., London. Messrs. H. M'Intyre and Co., Paisley, launched the *Ivanhoe*, a steamer of 250 tons, built to the order of Messrs. William M'Lachlan and Co., Glasgow. Messrs. M'Intyre and Co., launched also the *Redcastle*, a small screw steam ferry boat, for service at Inverness; and the *Gironde et Garonne*, No. 2, a paddle passenger steamer for French owners; and Messrs. D. and W. Henderson and Co., Partick, launched the *Vanduaka*, a 90-ton cutter yacht, for Mr. John Clark, Paisley. Messrs. A. M'Millan and Co. Dumbarton, launched the *Eleano*, a steamer of 1000 tons, for Messrs. Olano, Larrinaga and Co., of Barcelona and Manilla. Messrs. Alexander Stephen and Sons, Linthouse, launched the *Vincenzo Florio* a mail steamer of 3000 tons, for Messrs. J. and V. Florio, and Co., of Palermo. There has been a fair amount of work completed during the month in the lower district of the river, which includes Greenock and Port-Glasgow. Four steamers with an aggregate tonnage of 2430 tons and a barge for shipment to India were turned out. The yards are all now pretty busy, and orders continue to come in, about 4000 tons of new work having been booked since our last report, including a steamer for the French Transatlantic Company, a tug for the Forth Bridge operations, a number of barges for the Irrawaddy Flotilla Company, two sailing barques of 900 tons, and a large yacht for a Scotch nobleman. In the Greenock yards there are 14 vessels in course of construction, and in the whole district there are altogether 44 vessels, including barges and yachts, on the stocks, more than double the number of what was on hand a year ago. The work completed was as follows:—Messrs. H. Murray and Co., Port-Glasgow, launched a paddle-steamer of 900 tons register, named the *Rio Branco*, for the Brazilian trade; Messrs. R. Duncan shipped a barge in pieces to Rangoon; Messrs. Murdoch and Murray launched a screw-steamer, named the *Progress*, 250 tons, for the Great Northern Fish Carrying Company, Hull, and a screw-steamer, named the *Mirama*, 1000 tons, for Messrs. Raeburn and Viril, of Glasgow; Messrs. Russell and Co, launched from their Port-Glasgow yard a screw-steamer of 280 tons, named the *Harley*, for Mr. J. H. Harley, of Cork to be employed in the coal trade.—*Glasgow Herald*.

TORPEDO BOATS.

A very important improvement has, with the approval of the torpedo authorities at Portsmouth, Captain Gordon and Commander Wilson, of the *Vernon*, been introduced by Messrs. Yarrow and Co., of Poplar, into the second-class torpedo boats which they are building for the Admiralty. Hitherto the designers and constructors of these craft have been in the habit of simply supplying the boats with their engines, leaving the various Governments to fit the torpedo gear in any way they thought best. In many cases the work was badly done, and in any case the hulls were very much cut about and injured. No sooner was a boat received from the contractors than measures were at once taken by the dockyard hands to alter the position of the funnels, remove a bulkhead, or carry out some structural alterations with a view of facilitating the storing and launching of the fish torpedo. In the *Lightning* it was attempted to discharge the projectile from the bow by means of a pneumatic tube, while in the second-class boats the torpedo is discharged from swinging cradles or skeleton tubes amidship. Both plans are open to grave objections. In the first the men are wholly unprotected from the fire of the enemy; while in the other case it is necessary to arrest the progress of the boat before the run can be made. The cradles are slung in davits at the side, and so arranged that they can be easily lowered below the surface of the water. When the projectile is completely immersed it is allowed to pass out of the tube by its own propelling power, taking a direction parallel to the boat itself. Very excellent practice has been made with this plan, which is the one in general use on board torpedo boats in the English navy; but as considerable loss of time must ensue in lowering and starting the Whitehead, and this perhaps at a critical moment, the plan is attended with serious drawbacks. In the craft which the Messrs. Yarrow are now supplying to the navy the necessities of torpedo management are taken into account in the original design, and the boats are furnished to the Admiralty complete and ready for service, with all the torpedo gear and equipment fitted on board. In these the old method of lowering and discharging the Whitehead from a cradle at the side has been dispensed with. The new plan consists in building into the forward part of the boat two troughs, or half tubes parallel to each other, in which the two torpedoes, comprising the armament of the craft, lie ready for use. Immediately behind, and protected by a turtle shield, are a couple of impulse tubes of the ordinary piston-rod type, and which can be worked either by steam or compressed air, though in the English service the latter power has been exclusively adopted. These tubes are so arranged that at the will of the officer in charge either one or both torpedoes can be instantaneously ejected without causing any loss of speed to the boat or necessitating the presence of any of the crew on deck. The boats are provided with two funnels abreast, but well apart, so as to allow of a clear space in the middle of the deck, and the rear of each craft is protected by a swivel gun.

Messrs. Yarrow are also constructing a large torpedo boat for the Russian Government, which will be capable of steaming from the Thames to St. Petersburg. It is built after the model of what is known as the "Yarrow" type, being fitted with two funnels and a curved deck, and is provided with a modification of the plan for fighting the Whitehead already described. It measures 100 feet in length by 12½ feet in beam, and is propelled by a two-bladed screw, the shaft of which passes below the rudder, which is pivoted upon the propeller tube. In order to enable the boat to manœuvre at full speed, she is also provided with an auxiliary drop rudder forward, which can be worked in conjunction with the aft rudder. Her armament consists of six Whitehead torpedoes (two being in the guns ready for firing) of the ordinary 14-inch character, or four of the Russian type, which are much larger than those employed in the English service. These are fired from two torpedo guns, or impulse tubes, built into the boat forward, and covered by a turtle-back deck, which not only protects the gear, but adds considerably to the seaworthiness of the craft. This turtle deck is raised at the after end and slants forward to the level of the deck. The conning tower, whence the torpedoes are fought and the boat is steered, is immediately at the rear of the turtle-back, and has thus an unobstructed view. Boats of this new and formidable character are considered to possess much more offensive power than those of the *Lightning* type, which are only provided with one torpedo ready for use, and a couple of spare ones, and in which the projectile and the discharging apparatus are in a most exposed position.

LAUNCHES.

English.

Alverton.—On April 10th Messrs. Edward Whitey and Co. launched from the Middleton shipyard, West Hartlepool, an iron screw-steamer built to the order of Messrs. Middleton and Co., West Hartlepool. This vessel has large capacity both for deadweight and measurement cargoes, and is intended for the Indian, Transatlantic and Mediterranean trades. Her principal dimensions are:—Length b.p. 240 feet; beam extreme, 33 feet; depth of hold to Lloyd's height of floor plates, 18 feet. She has a double bottom all fore and aft on the longitudinal and bracket system, and has been built under Lloyd's special survey for the 100 A 1 class. She has topgallant-forecastle, long full poop, and bridge-house joined; Napier's patent steam capstan windlass; the chart-house, engine-room, skylight, rails and decks are of iron, and she will be rigged as a topsail schooner; her engines, of 120 horse-power, and her boiler, which is of steel, will be fitted by Mr. George Clark, Sunderland. As the steamer left the ways she was christened *Alverton*.

Stranton.—On the 30th March Messrs. W. Gray and Co. launched from their yard at West Hartlepool the *Stranton*, an iron screw-steamer, built to the order of the West Hartlepool Steam Navigation Company. Her dimensions are:—Length between perpendiculars, 256 feet 6 inches; extreme breadth, 34 feet 6 inches; and depth of holds, 19 feet 8 inches and 24 feet 3 inches. Gross tonnage 1760 tons, and will carry a deadweight of 2350 tons. Classed 100 A 1 at Lloyd's, and built under the special survey of Captain G. Wright. Engines 150 horse-power, by Messrs. T. Richardson and Sons, of the Middleton Ironworks, Hartlepool.

Villa d'Oran.—On the 10th April, Messrs. Wigham Richardson and Co., Neptune Shipyard, Low Walker, launched a most magnificent vessel from their yard. The ship is intended for the Compagnie Générale Transatlantique of Paris, and was named *Villa d'Oran*. She is one of the thirteen to be built in this country for the same owners, Messrs. Richardson having another of exactly the same size and dimensions well forward on the stocks at present. Four are being built by Messrs. Elder and Co. of Glasgow, two by Messrs. Inglis, Glasgow, two by Messrs. Caird, Greenock, and three others of a smaller size are being built by other builders on the Clyde. The dimensions of the *Villa d'Oran* are 320 feet long, 33½ feet breadth, and 25½ feet depth. Her tonnage will exceed 2000 tons, and her engine power will be capable of working up to 2000 horse power, and with such engines it is expected she will make, when fully laden, 14 knots an hour. The engines are well forward, and are being made by Messrs. Wigham Richardson and Co. in the same yard. The vessel is one of the largest passenger ships ever built on the Tyne, and, when completed, will certainly rank amongst the best passenger ships afloat. The *Villa d'Oran* will trade between Marseilles and Algiers, and will carry the postal service between the two countries. She will carry fully 200 first-class passengers, for whose comfort every luxury has been provided. The cabins will be fitted with all possible conveniences and in the most substantial manner. Messrs. Wigham Richardson and Co. expect to be able to launch the sister ship to the *Villa d'Oran* in the first week in May.

Scotch.

Allan Macdonald.—On April 9th, the Campbeltown Shipbuilding Company launched a steamer for the Salt Works Company. The vessel measures 119 feet by 19 feet 9 inches by 9 feet, and carries 260 tons. The engines were fitted up by Messrs. Ross and Duncan, Glasgow. The steamer was named the *Allan Macdonald*.

Diana.—On the 6th of April, Messrs. Charles Connel and Co. launched, at Scotstoun, the *Diana*, an iron sailing barque of 750 tons, built to the highest class at Lloyd's. This vessel is a duplicate of the *Comus*, built by the same firm in the middle of last year for Messrs. Barton and Co., merchants, Glasgow. Immediately after the launch she was towed to her berth to be loaded by Messrs. Thomas Skinner and Co. for Singapore and Penang.

Mercader.—On the 10th April the *Mercader*, a screw-steamer, about 70 tons, was launched at Leith by Messrs. D.

Allan and Co. She is built expressly for trawling purposes for Messrs. Mercader and Son, of San Sebastian.

Moise.—On April 12th Messrs. John Elder and Co. launched the first of four steamships they are building for the Company Générale Transatlantique. She was named the *Moise*, and is a vessel of 1850 tons. Her dimensions are 313½ feet in length between perpendiculars, 33½ beam, and 25½ feet depth, moulded. The engines, which indicate 2400 horse-power, are on the compound principle, inverted cylinders, and surface condensers, and steam is supplied by two circular double-ended boilers. The speed expected is fourteen knots per hour. She will be fitted with accommodation for sixty first-class, forty second-class, and sixty third-class passengers. The *Moise* is schooner-rigged, with pole masts of iron, and she will carry four lifeboats and two gigs.

Trial Trips.

Lord Jeffrey.—On April 5th, the *Lord Jeffrey*, built by the Tyne Iron Shipbuilding Company, Willington Quay, on Tyne, and engined by Messrs. R. and W. Hawthorn, of Newcastle-on-Tyne, for the firm of Messrs. Charles Tully and Co., had a successful trial. The vessel, whose dimensions are 270 feet by 35 feet by 24 feet 6 inches, realised a mean speed of 11·1 knots per hour. The engines have cylinders of 62 inches and 32 inches diameter and 40 inches stroke. With a steam-pressure of 90 lb. they developed 1020 indicated horse-power. The engines are the first that have been fitted with Mr. F. C. Marshall's "patent slide valve gear," which, owing to its simplicity and novelty, excited considerable interest; its working was perfect, and gave every satisfaction. She is fitted for general trades, having Messrs. Donkin and Nichol's patent steam steering gear, and all modern appliances, and is to be employed at the present time by the West African Steam Navigation Company.

Disasters at Sea.—There were thirty-four British and foreign wrecks reported during the week ending Saturday last, making a total for the year of 440, or a decrease of 133 as compared with the corresponding period of last year. The approximate value of property lost was £620,000, including British £450,000.

Canalisation of the Main.—By the projected canalisation of the Main, the river, it is said, will be rendered navigable as far as Frankfort by the largest vessels which can now ascend the Rhine to Mayence. To ensure the necessary depth of water, five weirs will be constructed between Frankfort and Mayence.

A New Torpedo Ram.—A new armour-plated torpedo ram *Polyphemus*, the only vessel of the kind under construction for the Admiralty, and which is being built at Chatham, is so far advanced that she will be launched before the end of the summer. Very great interest is taken in the vessel, and she has been inspected by the naval attachés of all the European nations.

Navigation of the Danube.—The Commercial Association of Ulm has informed the Danube Association, which has been formed with the view of promoting the navigation of the Danube in all directions, that it intends to make efforts to have, with the concurrence of the other towns on the Danube, a tug-chain placed in the river from Ulm to Passau. It is suggested that the chain be laid down in the river from Passau to Vienna, and along the river in Hungary (the Bill arranging this is already before the Diet). If the Danube Association will support such an arrangement of the navigation, the Commercial Association of Ulm will send delegates to Vienna about the beginning of May to consult over the matter. It hopes that Passau, Regensburg, &c., will also send representatives. On this the Danube Association has decided to call together a Danube navigation meeting, to which all the parties interested, in Austria-Hungary, Servia, Roumania, and Bulgaria, should be invited.

"Atalanta."—Seventy-two days having elapsed since the *Atalanta*, the sailing training-ship, was known to have left Bermuda on her return voyage to Portsmouth without intelligence having been received of her, it is feared that she may have been disabled by the lately prevailing high winds and driven out of her course. The *Atalanta* had on board 11 officers and about three hundred young seamen, exclusive of petty officers, selected from vessels at different ports for the purpose of being trained in practical seamanship. She was last signalled at Bermuda, on January 29th, and has been expected at Spithead for some time. The *Atalanta* is a similar vessel to the *Eurydice*, which was lost in a gale off the Isle of Wight, in March, 1878. She is commanded by an able and gallant officer, Captain Stirling, and left Portsmouth six months ago. Although the Admiralty had previously ordered the *Wye*, store-ship, to call in at the Azores on her way home from the Mediterranean in search of the missing ship, their lordships have since deemed it advisable to order the whole of the Channel Squadron, consisting of the *Minotaur*, *Agincourt*, *Achilles*, *Northumberland*, and the *Salamis*, to proceed to sea at once from Gibraltar, under the command of Rear-Admiral Hood, and cruise first to the Azores, and thence to Bantry Bay, with the object of picking up intelligence of the missing ship. The ships will open out within signalling distance of each other, by which means a large area of sea will be explored. A, telegram from Gibraltar, dated Wednesday 4.45 p.m., says:—"The Channel Squadron is now leaving for the Azores in search of the training ship *Atalanta*. The despatch vessel *Salamis* left yesterday on the same errand." The Admiralty has issued a statement to the effect that the *Atalanta* left Bermuda on the 31st of January for England; that nothing has since been heard of her; that she was then sound and in good condition, ably commanded and manned, and with ample water and provisions. There is still ground for hope, according to the official statement, that the missing vessel may be only dismasted and may yet arrive in safety.

The Designing of War Ships.—On Friday last week, at the United Service Institution, Major A. Parnell, R.E., read a paper entitled "Remarks on the Application of Iron-Plating to the Protection of Men-of-War, with Suggestions regarding the Employment of Unarmoured Ships in European Squadrons." Admiral Sir F. Nicholson presided. Major A. Parnell reviewed the discussions which have been raised at various periods by competent authorities, such as Mr. N. Barnaby, the Director of Naval Construction; Vice-Admiral Pouchat, the Controller of the French Navy; and Admiral Ryder on various points connected with the unsettled subject of armour plating on ships of war and the classing of ships, and summed up the result of the discussions as showing that in 1873 the opinion of authority, both in England and France, was practically that armour plating was not essential for the protection of the guns and gunners; while in 1878 the opinion of authority in England was that armour plating was not essential for the protection of the ship from being sunk. He held that it would be necessary to have armour-plated ships for attacks on well-armed European fortresses; but he thought that there should be a type of unarmoured ship to be devoted solely to operations against ships in the open sea and blockading an enemy's ports. He submitted that our ships for European war should be divided into two great classes, designed respectively for fortress and squadron warfare, as one kind of fighting was different from the other. The attack of fortresses would seldom involve the use of rams, Whitehead torpedoes, light guns or musketry. The essential characteristics of fortress-attack ships should be great powers of battering and of resisting battering, and light draught of water. These ships should be armed with the heaviest guns, and be protected by armour of immense strength. In addition they and their tenders should be thoroughly equipped for breaking booms, clearing away mines, and guarding against the attacks of torpedo craft. If we could see our way to the disuse of armour in the ships intended to compose European fleets and squadrons, our active navy would gradually resolve itself into three classes —viz.:—(1) Battering or fortress-attack ships, consisting of ironclads without sails, including most of our present turret ships, but consisting in future of ships specially designed for this warfare and reserved for attacking European fortresses. (2) Fighting, squadron, or battle ships, unarmoured, yet with their vital parts protected, without sails, of comparatively small size, and reserved for European squadrons. (3) Cruisers, comprising all existing sailing broadside ironclads, as well as all unarmoured frigates, corvettes, and sloops specially built for cruising. He entered into speculations as to the construction of Class 2, and he proposed to use in this class two bow and stern 10-inch (18-ton) guns, two beam centre-pivoted 12·5-inch (38-tons) guns, mounted *en barbette*, four bow and stern front-pivoted 7-inch (90-cwt.) guns, firing through ports, eight 64-pounders, and a complement of boat guns and Nordenfeldt's or other bullet machines. Each ship, too, would be built as a ram of 4,000 tons, with twin screws and two independent sets of engines. Captain Long, R.N., Commander Curtis, R.N., and Captain Cameron were among the speakers on the paper, and their criticisms were directed to points of detail, upon which Major Parnell admitted he had had no experience, adding that he had given suggestions merely for others to work out.

The Labour Market.—The return of the accountants under the sliding-scale arrangement for the regulation of wages in the Cleveland iron trade was issued on Friday last week. It shows that for the quarter just ended the average price of pig-iron has been in Cleveland a fraction more than 42s. 8d. per ton. The amount shows an advance of about 6s. per ton on the average for the preceding quarter; but as wages had at the commencement of the scale been raised in anticipation of an increase in prices, no general increase in the rates of wages will now take place. The return also shows how much lower the realised prices for iron have been than the market rates, for whilst the average realised for the last quarter has been under 43s. per ton, the market rate has varied from 50s. to 63s. per ton for the same quality—the long contracts at low prices having kept down the realised prices. On Wednesday morning a meeting of the Wear shipyard helpers ("blocksmen" and "boardsmen"), at present on strike, was held, with a view to secure uniform action by the men of the different yards affected. It was stated that in two or three yards the men had interviews with the employers, and the latter had expressed themselves favourable to the principle of piecework. A resolution was then carried unanimously pledging those present to stand firm in their demand for piecework in all yards. A strike amongst the marine engineers of Hull commenced last week, and is now proceeding. The men consider that in Hull they are the worst paid of any port in the kingdom, their wages some time ago, when trade was very bad, having been dropped from 10s. to 15s. a man. Previous to the strike the Society of Marine Engineers served the owners with notice, giving the various rates they should expect, their demand being practically a wish to return to the former rates of payment and number of engineers per steamer, which has also been reduced. It is stated that one firm has unconditionally granted the demand, and others have done so conditionally. The offer of one firm to return to an intermediate scale was rejected by the engineers. As the steamers arrive from sea the engineers proceed to strike. About 300 or 400 men are affected. A conference of the colliers of South Staffordshire and East Worcestershire, held at Dudley, terminated on Monday evening, with a resolution to organise for the purpose of securing an alteration in the Birmingham agreement whereby their wages vary to the extent of 3d. per day for each shilling alteration in the price of coal. The men want the 3d. raised to 4d. At a mass meeting of miners held in Ryhope Dene on Saturday, at which about 4000 men attended, all the collieries in North Durham being represented, it was unanimously resolved to agitate for weekly instead of fortnightly pays, and for the total abolition of the sliding-scale scheme. The recent sliding-scale returns imparted no reduction or advance in their wages for the next three months. They expected an advance owing to the price of pig-iron having varied between 50s. and 60s. during the past three months, but of course the returns are based upon working contract entered into by manufacturers at former lower rates. The Miners' Association's secretary and agent are advising them to examine the situation, and a mass meeting is called for Wednesday next at Marske. About two hundred miners at the Hanley Bucknall Colliery, Staffordshire, are now on strike against a proposed reduction of 10 per cent. in wages.

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TO CORRESPONDENTS.

Errata.—In Mr. Pendred's paper on Distillers, in the report of the meeting of the Society of Engineers, last week, on page 258, line seventy-four, for "Granby" read "Graveley;" and near the bottom of the column, after the words "for land purposes," add "by Mr. Chaplin, of Glasgow."

NOTICES OF BOOKS.

Parliament and the Constitution. By Joseph Pullan. (Stewart's Educational Series.) London: W. Stewart and Co.

This is a popular exposition of the rules, forms and usages of the British Parliament, intended, we presume, for the use of schools, but containing a mass of useful and generally correct information with regard to both Houses of Parliament, their constitution and procedure, which many electors would find very interesting, and perhaps also novel. The author, after a short introduction, commences with the description of the mode of election, and concludes with that of the prorogation. Appended there is a concise and generally accurate descriptive and historical account of the British Constitution from the Conquest to the passing of the last Reform Bill, which, from its very brevity, will give to those ignorant of this branch of the history of England a better idea of the development of British freedom than would a long and learned treatise.

Engineering Geology. By Henry Penning, F.G.S London: Baillière, Tindall and Cox. 1880.

There is scarcely a branch of natural science from which an engineer may not derive essential assistance in his special art; and a knowledge of the constitution, structure and arrangement of the earth's strata, on which his work rests, or through which it is carried, is obviously a matter of primary importance. The safety of bridges, tunnels and embankments, and the usefulness of drainage works, leaving mining and water supply out of the question, more or less depend upon the nature and position of the underlying or superincumbent rocks. The department of geology, however, which is most important to the engineer is not so much the theoretical or historical part as the stratigraphic. The nature of the rocks, as regards hardness, liability to weather, dip and direction, together with their chemical composition, are what he is chiefly interested with; and the author here shows how, for acquiring information on these matters, the methods of the field geologist are much surer and more complete, as well as easier of application, than the usual methods of sinking trial holes or making deep and costly borings. For the engineer requires to know not only what beds are to be found under the surface on the site of his work but their lie, outcrop, dip, and other characteristics, upon all of which the stability and durability of engineering works must depend. The author accordingly supplies the rules and methods relating to stratigraphical geology, that is for ascertaining the extent of the various strata, their lithological character, their order of succession, and their position with respect to the horizon. Under the first head the qualities of the different rocks are distinguished, some useful, and others to be guarded against in mechanical operations. The permeability of rocks is an important matter, as bearing upon the question of land-slips, and that and the relative position of the strata have much to do with the dryness or dampness of sites, especially at the outcrop of the beds. A good deal of the required information is given in the maps of the Geological Survey, especially those on the 6-inch scale; but many of the more minute local peculiarities of the different areas are not given, and these will have to be traced out by the engineer himself. It is important, also, that suitable material should be obtained as near as possible in the neighbourhood; and as rocks vary much in quality over even a small space, whether such material is procurable or not will have to be ascertained in each individual case. The dip of rocks is also a very important consideration in railway construction, both in respect of tunnels and banks. Having shown the importance of a full acquaintance with the geological structure of the scene of engineering operations, the author proceeds to give a full and lucid description of the procedure in the field, including surveying and mapping, and diagnosing the various minerals which the surveyor will meet with. The third part of the manual is occupied with a description of the economic products of all the strata, palæozoic, secondary, tertiary, and recent, which constitute the earth's crust, and dissertations on springs and water supply; the concluding chapter being devoted to the important question of the selection of building sites, considered both from an æsthetic and sanitary standpoint.

The Geological Record for 1877. Edited by WILLIAM WHITAKER, B.A., F.G.S. London: Taylor and Francis. 1880.

HOWEVER conscientious and industrious the compilers of scientific manuals may be, they must always find great difficulty in bringing their works up to date; but a record like the one before us must be of much value to those labourers in literature whom Dr. Johnson described us even more useful to their contemporaries than original writers; while to such outsiders as are not aware of the innumerable observers who are evermore building up sciences as the coral animals construct islands, a glance over its pages will act as a revelation. Well on to 400 pages of an octavo volume, in medium-sized type, are here occupied with little beyond the titles of books and discourses in the various departments of geology nearly all issued in one year: and the editor in his preface hints that his brethren of the hammer and chisel are nevertheless in the habit of "eloquently discoursing of the imperfections of the *Geological Record.*"

The Export Merchant Shippers. London: Dean and Son. 1880.

THE issue for the present year of this useful directory and desk-book contains a number of additions and improvements which add considerably to its value. To most of the mercantile men in the United Kingdom and the Colonies it needs no introduction. It may, however, be observed that it embraces an alphabetical list of merchants in all the principal English ports, with the names of the ports to which they ship and the goods they usually export, to which is added an alphabetical list of ports all over the world, both divisions being arranged so as to be suitable for hasty reference. Then follows an alphabetical list of goods and merchandise shipped, with the names of the shippers, a manufacturers' trade directory, indices, and a quantity of miscellaneous information. Prefixed is a table of exports and imports for 1878-9, giving opposite the name of each port values of exports and imports from and to the United Kingdom for the year, with a list of the principal exports of each port and province, by which exporters and importers are enabled to obtain at a glance the whole of the information necessary to be known in shipping. Much care has been taken to secure accuracy of detail, and among the large additions made to the present year's issue may be mentioned classified lists of Sheffield, Glasgow, Newcastle-on-Tyne and other important places.

NEW BOOKS.

Brazil: The Amazons and the Coast. By H. H. Smith. 8vo. Low and Co.
Description of the Differential Expansive Pumping Engine. By H. Davey. 8vo. Spon.
Hints to Young Architects. By George Wightwick. New Edition. 12mo. Lockwood and Co.
Metrical Tables. By G. L. Molesworth. 32mo. Spon.
Potable Water: The Suitableness of Water for Drinking Purposes. By C. Ekim. 8vo. Churchill.
Saws: The History, Development, Action, Classification and Comparison of Saws of all Kinds. By R. Grimshaw. Spon.
Science (The) of Voice Production and Voice Preservation. By G. Holmes. F. Chatto.
Sea (The). By F. Whymper. Vol 3. Illustrated. Cassell.
Treatise (A) on Steam Boilers. By R. Wilson, C.E. New Edition. Lockwood and Co.
Tables for the Purchasing of Estates. By W. Inwood. 21st Edition. 12mo. Lockwood and Co.
Watering Places (The) and Mineral Springs of Germany, Austria and Switzerland. By E. Guttmann. 8vo. Low and Co.
Weather (The) of 1879, as Observed in the Neighbourhood of London. By E. Mawley. 8vo. Bemrose.

FACTORY NOTES.

The Tin Trade.—The Cornish smelters on Monday reduced the tin standards by £3 per ton. The standards now are—superior common, 84s.; superior fine 85s. per cwt.

Spence's Patent Metal.—Mr. Spence informs us that he has appointed his firm, Messrs. J. Berger Spence and Co., 31, Lombard Street, his sole agents for the sale of Spence's patent metal.

Midland Railway.—The Directors of this well-managed line are about to increase by forty the number of their engines—one-half being for passenger and the other half for goods trains; and ask for tenders to be sent in not later than the 4th proximo. Particulars will be found in our advertising columns.

THE will of Mr. Henry Charles James, late of 10, Austinfriars, metal broker, who died on November 16th last, at 33, Regent's Park Road, was proved on the 25th ult. by Mr. Kenneth Haweis James, the son, the acting executor, the personal estate being sworn under £60,000. The testator's wife having died, all his property is divisable under the will between his children in equal shares.—*City Press.*

Locomotive Boilers.—In reporting on the explosion of the boiler of an engine attached to a train of empty waggons on a mineral line at Silksworth Colliery, near Sunderland, on the North-Eastern Railway, Major-General Hutchinson says:—"During the past five years there have been altogether fifteen explosions of the boilers of locomotive engines, of which no less than nine have occurred on the North-Eastern Railway. This is a state of things which, I submit, deserves the very serious attention of the directors."

South Kensington Museum.—Visitors during the week ending 10th April:—On Monday, Tuesday and Saturday (free), from 10 a.m. to 10 p.m., Museum, 10,864. Mercantile Marine, Building Materials, and other Collections, 1850. On Wednesday, Thursday and Friday (admission 6d.) from 10 a.m. till 6 p.m., Museum, 2271; Mercantile Marine, Building Materials, and other Collections, 108. Total, 15,093. Average of corresponding week in former years, 15,414. Total from the opening of the Museum, 18,849,265.

The Boiler Insurance and Steam Power Company (Limited).—At the usual monthly meeting of the board, held at the head office of the company, 67, King Street, Manchester, Mr. M'Naught in the chair, the chief engineer, Mr. M'Dougall (late inspecting officer to the Board of Admiralty) reported that during the month of March 6861 boilers had been examined by the officers of the company, of which number 104 were internally and 1262 thoroughly examined. The principal defects found in the boilers were as follows:—Corrosion of plates and angle iron 112; fracture of plates and angle iron, 25; safety valves out of order or overloaded, 84; pressure gauges out of order, 48; water gauges out of order, 42; boilers damaged from overheating in consequence of deficiency of water, 7; boilers damaged from overheating in consequence of deposit, 2.

The Iron and Coal Interests in Parliament.—As a supplementary list to the notice which appeared in our columns last week it may be stated that Mr. R. Winn, one of the largest owners of ironstone in North Lincolnshire, has been returned for that division. Mr. H. H. Fowler, one of the members for Wolverhampton, is a director of several great limited companies in that district, as well as a solicitor to the Chillington Iron Company and the Mines Drainage Commissioners. Mr. Chamberlain, of Birmingham, is president of the South Staffordshire Mill and Forge Wages Board, and, prior to his retirement, was one of the firm of Messrs. Nettlefolds, who own large collieries and ironworks in Shropshire. Another of the members for Birmingham—Mr. Muntz—is identified with the firm of Messrs. Muntz and Co., metal brokers, of Birmingham and Great Bridge. Mr. Plimsoll, the member for Derby, was in early life a coal owner, and of later years he was identified with the patent coal drops at King's Cross. The member for East Staffordshire, Mr. Wiggin, is engaged in business in Birmingham as an iron and metal merchant. And Mr. J. S. Balfour, who has been returned for Tamworth, is a large owner of collieries near that town. Mr. Craig, one of the representatives for North Staffordshire, is not only a large coalowner, but president of the North Stafford Mining Institute. The Member for Bridgnorth, Mr. W. H. Foster, is the son of Mr. W. O. Foster, the principal of the firm of John Bradley and Sons, the owners of large ironworks at Stourbridge and Kidderminster, and blast-furnaces and collieries at Kingswinford. The Hon. W. H. Fitzwilliam, who was elected at the head of the poll on Saturday for the southern division of the West Riding, is the eldest surviving son of Earl Fitzwilliam, the owner of extensive collieries near Barnsley, and the lessee of the Milton and Elsecar Ironworks. One of the members for West Worcestershire, Colonel Knight, is the head of the firm of John Knight and Co., of the Cookley Ironworks. Amongst the defeated candidates connected with the trade mention may be made of Mr. W. S. Stanhope, of Cannon Hall, the lessee of mineral property in South Yorkshire.

IRON AND COAL TRADE REPORTS.

BARNSLEY AND SOUTH YORKSHIRE.—It is some time since the house-coal trade presented a more depressed state than it has assumed during the past two months. The position of affairs is a very serious one, for whilst, on the one hand, business is quiet, prices are also so much depressed that the working of collieries in this district seems to be almost an impossible task. The business doing with London continues very moderate. Advices from the metropolis to some of the leading collieries show that there was no improvement in price on the Coal Exchange on Monday last. An analysis of the returns shows that there was a decrease in the imports by rail during last month of 15,500 tons, whilst the increase by sea was 17,000. This, to a great extent, bears out the position held by the district coalowners here, who declare their inability to compete with seaborne coal, seeing that the importations of coal by water last month were larger than in any corresponding period from June, 1872. There is also a limited tonnage passing along the lines to Lincolnshire and the Eastern Counties, notwithstanding the fact that the weather remains cold. There is a fair demand for steam coal, but the large number of collieries sending to Hull and Grimsby causes the trade to be much more divided than it used to be. The returns of the coal sent from the various pits in South Yorkshire to Hull during last month shows that in most cases there was a falling off. The exceptions are Carlton Main, Carr House, Featherstone. The decrease in some cases is very marked. Swaithe Main sent 368 tons against 812 in the previous month; Thryberge, 3220, against 8066; Wharncliffe, Silkstone, 3144, against 6932; and Wombwell, 820, against 1814 tons. There is a good business doing with Grimsby, which port is more easily reached by the bulk of the collieries. Of late a very great business has been done in small coal and slack for manufacturing purposes, but now that the elections are over it is expected that an improvement will set in. The coke trade is still very good, and more ovens will soon be at work, which will greatly add to the output of the district. There is but little new to note respecting movements connected with mining operations. There seems to be but little new to note in connection with the iron and steel trades. The Yorkshire Steel and Iron Works at Penistone continue to be run full time. There is scarcely so much doing in the iron trade at some of the works where miscellaneous goods and castings are produced. Puddlers at Milton and Elsecar are kept fairly going, and the same remark will apply to the rail-plates and merchant mills, all of which are regularly worked. The position of the pig-iron trade, so far as the output is concerned, remains unchanged, there being the full complement of furnaces in blast. A good deal of interest has been evinced in the annual meeting of the shareholders of Thorp's Gawber Hall Collieries (Limited), which was held in London towards the close of last week. The meeting was private, the accounts showing a loss of over £4000 on the year's working. It is, however, stated that the accounts during the past quarter are more favourable, and hopes are entertained that the working of the pits will yield better results.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—The hematite pig-iron trade of this district seems to be going backwards as quickly as it advanced a few months ago. Very little demand has been experienced during the past few weeks, and some makers have not booked an order for two months. The American market is very flat, and buyers of iron are not disposed to speculate even at the reduced value which now exists both for pig-iron and steel. There is on the other hand a fair enquiry as to terms of future delivery. It is well known that makers generally have their hands full for a greater part of the year, and that therefore the present lull in demand does not affect them. On the contrary, there is in the fact of a scarcity of hematite pig-iron for immediate delivery, a very strong barrier against the market relaxing too fast. On every hand the output of the works has been increased to their greatest extent, and it is noteworthy that the production is showing a gradual increase while the demand is in the opposite direction. The great attention devoted to election and other matters at the present moment has diverted many buyers from speculating, but there is a general belief that confidence is being restored in such a way as will lead to the groundwork of a long period of good and steady trade. From the colonies a considerable demand for hematite iron is expected, and it is believed as the steel trade throughout the world is more and more extended, there will be an increased and increasing request for that quality of metal, which abounds in this district. Local makers of steel are very busily employed, and considerable parcels of crude Bessemer and forge iron are being despatched to Sheffield and other steel manufacturing centres. The shipbuilding trades are fairly employed, but there are very few enquiries from shipowners for new quotations of new work. Engineers and iron-founders are very steadily employed while boiler-makers and railway rolling stock manufacturers are in receipt of orders which will furnish activity in their works for the greater part of the summer. Iron ore is steady in tone, at from 25s. to 30s. per ton. Coal and coke in good request at unchanged values. Shipping busy.

BIRMINGHAM.—The course of trade in the local hardware industries has not yet resumed its normal condition after the interruption occasioned by the election and the Easter holidays. So far as the latter disturbing influence is concerned there are only a few firms whose machinery has not commenced running again, and in these cases the stoppage arises from the fact that it is still under repair. The effect of the elections, however, continues to be felt very considerably, as scarcely any orders have been coming in from travellers, or by letter, except from a few of the leading manufacturing towns and certain districts in Scotland. The export trade, too, is below the season's average, although a somewhat better run of orders has been experienced recently from France, a few of the northern European ports and Canada, as well as from the Levant and ports of the Black Sea. A fair quantity of edge-tools and hollow ware has also been in demand for Brazil and other markets on the eastern coast of South America, and British Indian orders for special classes of goods continue moderately good. Manufacturers generally, however, report business as slack, and a good deal of the work which is being turned out is on stock account. Metal rollers are only doing a very quiet trade, and the demand for tubes has fallen off considerably. Both iron and steel wire drawers are better employed than has been the case recently, chiefly on home account. Local manufacturers of axles and springs have been making fair shipments of strong rough goods for the South African and Australian colonies, and are still busy on similar work for the same markets and for India, as well as on order for better-class work for the metropolis and the North of England. The export trade in low qualities of iron bedsteads has manifested a slight improvement, and bicycle manufacturers have been somewhat busier. There has been a better demand for cabinet brass-foundry, and galvanised iron goods are in steady and improving request. Gas-stove manufacturers report more animation in their branches of trade, and button and military ornament makers have a fair run of orders on hand. Prices in most departments have remained tolerably steady, owing to the firm tone of the metal markets. Owing to the specially favourable weather, a better tone is reported as prevalent in the agricultural districts, and it is confidently anticipated that with a continuance of seasonable weather, a considerable improvement in trade will set in as soon as the country has quieted down from the electioneering excitement. The New Zealand mail which came to hand on Tuesday, scarcely met expectations, as the orders received were scarcely up to the average of recent mails, the heavy consignments which have been sent out, having somewhat overstocked the colonial market. A sprinkling of ovens from London houses, on account of Australian firms is also reported, but no transactions of any magnitude. In spite of the recent advance in hollow ware this branch of trade shows increasing activity both as to tinned and enamelled goods. Some of the local tube firms have advanced discounts 5 per cent. In the local iron trade the aspect of affairs has undergone no material change during the week. It has transpired that some fair specifications for nail-rod and galvanised iron were placed on 'Change at quarter-day, for the Australian and South American market, and that hoop-iron and strip was also bought to a limited extent on American account, but the business done altogether was considerably below the anticipated average, and the features of the meeting has had the effect of weakening rather than of strengthening the trade. On Wolverhampton exchange on Wednesday, considerable anxiety was shown by manufacturers to book orders, and concessions were made with this object in view, which would not have been entertained a few weeks since. Buyers, however, were shy notwithstanding the weakness of quotations.

Thursday Evening.—Only small attendance on 'Change to-day, and business very quiet all round; no quoted change in prices, but, in absence of transactions there, difficult to estimate accurately. Unmarked iron decidedly weak; orders are not urgently needed by makers, but unless trade improves, production must shortly be curtailed. Galvanised iron in better demand than other makes, and some firms in this line here have good export orders on hand.

CARDIFF.—There is general confidence in the future of the iron trade, and none the less so, because business is leaving the hands of speculative dealers and getting into the hands of legitimate channels. The reaction in prices is no measure of the exhaustion of demand, but rather of the necessities of such persons as made of the metal market a gaming table. The consumers who hid themselves until the half-flying storm had past are now coming forward one by one, and all the elements of a sound and healthy trade for some time to come, are believed to be present in the actual situation. Experiments are being made at Cyfarthfa with a view to a greatly improved description of iron bar and rail. Foreign ores have experienced a signal decline. Bilbao ore having accomplished a slide of from 6s. to 8s. in a comparatively short period. The large make of iron has began to tell upon the severity of the competition of the ironmasters as coal-producers with the colliery proprietor proper. There is a substantial alleviation, which has not a little strengthened the prices of steam-coal. Even the house-coal trade has benefited, some seams formerly sent into that market being now reserved, lumps and all, for the coke ovens. There is an increased demand for shipments in the Mersey, the additional spring sailings having commenced, and emigration continuing on an unusual scale. Full time is the rule at the collieries, and there is no surplus of colliers; indeed, if the hands out of employment in the Forest of Dean were to migrate to South Wales, doubtless most of them could be accommodated with a stall. Freights continue to rule low, and those to London are affecting the amount of Great Western Railway traffic, in spite of the superior condition of coal land-carried.

CLEVELAND.—There was a fair attendance on Change at Middlesborough on Tuesday, but there was no great amount of business done. Prices are flatter than they have been for some time, the American fall and the Glasgow decline having operated most fully. This is chiefly confined to the merchants, however, makers being sold well enough not to feel it so immediately. Sellers, 50s.; buyers, 49s. Meantime, the stock of Messrs. Connal and Co's. stores is decreasing chiefly on account of shipments arranged some time ago. Forge-iron is slightly dearer than No. 3. The labour difficulty is again cropping up in the case of the Cleveland miners. They declare they have been deceived by the actual terms of the sliding scale, and are seriously discontented. They have found out that the inflated prices are not to be taken as if actually realised. They expected 2d. a ton more than they have been found actually entitled to. The finished-iron trade remains unchanged. Some firms have plenty of orders, others are not so well off; the prospect for all is not quite so bright. Puddled iron, £5 2s. 6d. to £5 5s.; plates, £8 10s. to £8 7s. 6d. Iron founding is duller than it has been for some good time back. Engineering is pretty steady. Household coal is rather brisker, but steam-coal has fallen off. There is no change in price. Manufacturing coal is much the same as it was. Coke has fallen in sympathy with iron—13s. 9d. per ton immediate delivery, and 14s. delivery over next six weeks. Business in general is rather better.

DERBYSHIRE.—No great change can be noted with respect to the coal trade in this district during the past week. The collieries are scarcely so well employed as they were a short time ago. The Midland Railway Company, which draws largely from this locality, holds well up with regard to its coal traffic. During last month it carried more by 1201 tons than it did in the same period of last year, whilst the tonnage was also in excess of the corresponding month in the three previous years. A fair tonnage of house and gas coal is being forwarded to the midland counties, whilst several local collieries have some good contracts for locomotive coal. Steam-coal is in fair request, and a fair quantity is leaving the district for shipment and smelting purposes. Engine fuel is not in such good demand; but, there being a large consumption for coke-making, this branch of the trade assumes a better and more beneficial aspect. Lead-mining continues to be carried on in but a moderate degree. It is satisfactory to learn that the Chesterfield and Derbyshire Institute of Engineers are turning their attention to this important but somewhat neglected branch of industry. Mr. A. H. Stokes will shortly submit a paper on "Lead-Mining" to the members, who are considering the desirability of making a tour through the county where the mines are situate. There is but little new to note respecting the iron trade. The output of pig-iron is much the same as for some time past, but prices are lower. There is not so much activity in some of the lighter branches of the trade, but extra activity is looked for now the turmoil of the elections has passed.

DURHAM.—The expectation that the elections being over better trade would be likely to ensue—a colouring to which view was given last week—has unfortunately not been a characteristic of the trade this week. Prices have been very much weaker in pig-iron, and the inquiry which was again beginning speedily disappeared. No. 3 has this week been offered at 50s. and less net. Buyers have been endeavouring to buy for considerably less, but sellers do not care to give way. The continued less satisfactory reports from America are having a depressing effect, firstly upon the Scotch market and secondly upon the market of the North of England. The question is eagerly canvassed by those in the trade as to whether the late revival is a real one or a mere "spurt." Will it continue, or will the demand decline and prices descend still lower? Just now, not only in the North of England but in South Wales and other iron districts, we hear of great quietude of trade, scarcity of orders and lower prices, and as a result thereof there is some little apprehension as to whether there may be any real permanence of trade can be looked for. The preponderance of opinion is, however, in favour of a larger demand appearing before Midsummer. Hence makers and the larger holders of iron are not inclined to sell at the present rates, but will hold their iron with a view of doing better with it. The manufactured iron trade keeps pretty much on a par with pig metal. There were more inquiries springing up last week in this department, but they have been checked by the return of a duller tone in the pig-iron trade. The prices of manufactured iron are not changed from last week. The local mills and forges are going on favourably. At Consett, Bishop Auckland, Welton Park, Darlington, and on the South Bank of the Tyne the various ironworks are at present well employed. The collieries are also making fair time, except where household coals are turned out. The return of the accountants giving the average price of coal at 4s. 4d. per ton, which does not carry a rise in wages, has caused some of the pitmen to express dissatisfaction. They look at the high prices which were for two months quoted for coke, but the fact must not be overlooked that such quantities as were sold at these rates were of the very smallest, the great bulk of the coke being bought by consumers last November at but little in excess of the old prices. Coke now is 14s. to 15s. delivered at the Cleveland furnaces.

FOREST OF DEAN.—The political conflict having terminated in accordance with the views of a large proportion of Forest masters and men, it is now hoped that the desired settling down to re-invigorated activity may speedily accrue. Whilst excluding a political bias, it is interesting to remark that Mr. W. Crawshay, in speaking to several thousand Forest men on the eve of the election, stated that the Crawshay's never made money under a Conservative Government, and if they didn't make money when could they give good wages. Upon this theory, correct or otherwise, it is not for me to comment, we may hopefully look forward to a brightening of the times so devoutly deserved in this disteict, where what improvement a few months ago occurred in the iron trade, has subsided. The firm alluded to are holders of considerable stocks of first-class pig-iron, and have in no way relinquished production. Their mines are moreover in full operation, which, regarding the reaction in the iron trade, is rather a hopeful sign of the times. In the Forest the opinion still prevails that the retrograde movement in the iron industry will be only of a temporary character, and the present aspect of affairs is the anticipated issue of indiscreet speculation by parties who are now forcing their material upon the market. A second unfavourable influence was the extraordinary rise in values, the volume of which was unprecedented. There is less activity in the demand for tin plates, nevertheless the productive element has not materially slackened. With regard to the coal trade it may be said that in the Cinderford Valley there is a little movement of an improved character, and, at any rate, steadier and more regular work at the leading pits. The colliery proprietors are pressed by the competition from Staffordshire and South Wales, and quotations are thus beaten down to a very low margin. A good average trade is being done in manufacturers' coals, this branch being improved by the long period of dry weather. In the western part of this district a great deal of suffering has eventuated as a consequence of the stoppage of the Parkend Collieries. The pits in question have afforded employment to 700 men and boys. A month ago, after many weeks of slack trade, the collieries were closed—it is believed only temporarily—as a result, the employés and their numerous families are reduced to very straitened circumstances, and they are being, to a large extent, fed by private charity. Mr. T. Nicholson, a local philanthropist, is in communication with the Hon. I. K. Howard, of the Woods and Forests Department, and the local Crown representative, Sir James Campbell, in order, if possible, to provide relief works for the suffering men. It is stated that the collieries will be very shortly restarted, but it is feared the report is a mere imaginary one, and not founded on any reliable information. The issue is believed ts be brought about primarily as a result of the great depression in trade, and some misunderstanding among members of the proprietary, the chief of whom is, unfortunately, in an alarming condition of health.

GLASGOW.—The warrant market again shows a decided downward tendency, which began last Friday on a report that the ironmasters at Philadelphia had agreed to reduce the price of their pig-iron by ten dollars per ton, in order to keep out British iron. This produced somewhat of a sensation, and frightened many holders into selling large parcels for cash. Buyers are holding off, affected by the adverse reports which are daily being received from America. It is curious to note that in spite of reports that the markets on the other side are completely gutted, 9425 tons of Scotch pig-iron were shipped thither last week. At the moment there is an utter want of confidence, and the leading operators are thereby aided in their endeavours to depress prices. On Thursday from 56s. to 55s. cash, and 55s. 3d. a month was accepted, declining on Monday to 54s. 2d. cash, and 54s. 5d. a month, next day fluctuating between 54s. 4½d. and 54s. 9d. cash, and 54s. 5¾d. a month. On Wednesday heavy selling took palce, from 54s. 3d. to 52s. 7½d. cash, and 54s. 6d. to 52s. 10½d. a month. Closing, buyers 52s. 9d. cash to 53s. a month, sellers 3d. per ton more. There is no demand for makers' iron, although prices have been reduced 3s. to 4s. per ton. No. 1 Coltness and Gartsherrie are now 62s. per ton; No. 3, 58s. per ton. No. 1 Eglinton, 58s. per ton; No. 3, 54s. per ton, but less would be accepted. The shipments of pig-iron from Scotland last week were:—Foreign, 13,454 tons; coastwise, 4855 tons; total, 18,309 tons, against 12,913 tons in the corresponding period of last year. The imports of Middlesborough pig-iron into Grangemouth last week were 2185 tons, against 5905 tons in the similar period of last year. The total imports into Grangemouth till April 10th, 1880, are 67,015 tons, against 76,112 tons till April 12th, 1879, showing a decrease for this year of 9097 tons. There has been very little movement recently in the stock in Connal's store, which now amounts to 438,408 tons. The manufactured iron trade is quiet; the old contracts have not yet run off, but no new orders are coming forward. Buyers have again begun to pursue a waiting policy, in the expectation that prices will yet go lower. The exports last week were very small—the chief items being for North and South America, wrought-iron manufactures valued at £2834; for Natal, cast-iron goods, at £1254; for Bombay, wrought iron, at £1030. There are no signs of any improvement taking place in the shipbuilding and engineering industries, and the outlook for the summer is anything but satisfactory. The steel works are very busily employed, and will be for some time to come, on the orders booked some months ago. The coal trade is extremely quiet; sales are difficult to make, and a reduction in wages is felt to be a necessity.

LANCASHIRE.—Business is now settling down after the excitement of the elections, but there is still only a very dull tone to report in both the iron and coal trades of this district. The downward movement at Glasgow and Middlesborough has naturally had a depressing effect upon this market, and local sellers have been compelled to take less money to secure orders. The unfavourable reports from America and the falling off in the demand for export have also naturally tended to produce the weak tone in the market; this has not destroyed the feeling of confidence with regard to the future, and one healthy feature is a better enquiry for home consumption. As I noticed in my last report, the local branches of industry are improving, and there are plenty of indications of increased requirements; but for the moment the weakness of the market naturally stands in the way of any large orders being given out, whilst makers who are getting near the end of their contracts are in some cases displaying rather a nervous anxiety to secure fresh orders, the result of which is that their prices have to give way. The easier tone which I reported last week with regard to Lancashire pig-iron has become more pronounced, and now the nominal quotations for foundry and forge iron delivered into the Manchester district are about 65s. per ton, less 2¼ per cent., whilst good orders would not be refused at 2s. 6d. per ton under this figure, so that for local iron prices are about 7s. 6d. per ton lower than they were last month. Very much the same may be said with regard to Lincolnshire and Derbyshire irons, which can now be bought from some makers for delivery into this district at about 65s. to 66s. per ton, less 2½ per cent. Some of the best brands of Middlesborough iron have been offered merchants for delivery into this district at 58s. per ton net cash, and the well-known brands of Scotch iron can be bought at about 66s. 6d., with inferior qualities offering at fully 1s. per ton below this. In the finished-iron trade there has been an easier tone, for although most of the local makers are still tolerably well supplied with orders, many of them are in want of specifications, and for all descriptions of manufactured iron lower prices are now being taken. Bars can be bought from makers at from £8 5s. to £8 10s. per ton, hoops at £10 to £10 10s., iron rails at about £8, and steel rails at about £9 10s. per ton. In the coal trade there is still only a poor demand for all descriptions of round coal. The pits in most use are working short time, and heavy stocks are held at most of the collieries. Prices, however, are now so low as scarcely to admit of further reduction, and there is a further disinclination to sell forward at present rates. For best coal at the pit mouth the average price is about 8s. per ton, seconds 6s. to 6s. 6d., and common round 5s. to 5s. 6d. per ton. For engine classes of fuel the market continues very firm, owing to the present small production of slack, and prices have a hardening tendency. For good slack 3s. 6d. to 4s. is obtained, and common sorts cannot be bought under 3s. per ton at the pit. For burgy about 4s. 3d. to 4s. 9d. is now being quoted. A few more enquiries are reported in the shipping trade, but generally this branch of business is still very dull.

LEEDS AND WEST YORKSHIRE.—The iron trade of this district shows decided signs of falling off Prices have been dropping for this last six weeks, and are now returned to something like what they were before Christmas. Most of the works are yet fairly employed, but there are very few new orders coming to hand, and som. difficulty is experienced in getting specifications on account of old contracts. No doubt, this is caused by the utter cessation of the American demand, in conjunction with the disturbance of business during the late elections. Notwithstanding the present depression, however, there is a hopeful feeling for the future. The splendid weather during the just-expired seed-time gives promise of an abundant harvest, and on all hands it is admitted that the Americans must again come here to buy somewhere about the end of June, or even before, now that prices have assumed something like a moderate tone. Cleveland pig-iron has been sold in this district as low as 59s. for No. 3 delivered, but these were exceptional lots, 62s. being the ruling figure. Scotch iron has declined considerably in price, and can now be had delivered here at only 5s. per ton above the Cleveland price, whereas the normal difference is 10s. or 12s. Hematites are 30s. per ton down from the highest price, and there are no ready buyers, even on those terms. But, again, these are chiefly second-hand parcels, many of the makers adhering still to the 130s. per ton at the works. The blast-furnaces in this district are well employed, the Aireside Hematite Iron Company having their three large furnaces in blast, producing over 1500 tons per week. The West Yorkshire Iron and Coal Company have also three out of their five in full operation, and are getting the others ready as quickly as possible. This latter firm are putting up Cowper's patent firebrick stoves for heating the blast, from which they expect great results. The forges have been much quieter, chiefly owing to the elections, but, as above mentioned, they find some difficulty now in getting specifications. The most of them have heavy contracts for some time to come for plates, sheets, &c., and the makers of nail-sheets are fully employed. Some of the larger tool makers have had good orders lately, and are fairly employed. The same remark applies to the machine makers. Founders have not so much to do, as there seems to be a lull in the building trade, and consequently little demand for heavy ironwork. The coal trade keeps very dull, no doubt caused by over-production, many new collieries having been opened the last few years in the West Riding, and every one of them on a large scale, capable of drawing 5000 or 6000 tons a week.

LONDON.—The metal market closes this week with a better tone in some departments. Iron, however, while keeping its advance for makers' brands, is selling at reduced prices in common qualities. Copper has receded to £59 10s. for Chili bars, but to-day has been sold at £61, closing firm at this figure. Tin also seems to have taken a turn, £81 finding many buyers, £82 forwards. English ingots, £90. Lead better; English pigs, £16 15s. to £17; Spanish, £16 10s. Tinplates.—While second-hand lots have been pressed for sale, makers seem sanguine of better prices.

NEWCASTLE AND THE TYNE DISTRICT.—The excitement of political rivalry has about subsided in this locality, and commercial affairs receive more attention than for some weeks past. In spite of the large exports of iron and the diminution of stocks, the pig-iron trade is much weaker, owing to the dulness and fall of prices in the Scotch and Cleveland markets. Both merchants and manufacturers offer No. 3 at 50s., and for No. 4 force 50s. 6d. to 51s. is the current price. The recent buoyancy of the finished iron trade has also received a check, and the rates have given way to a slight extent. Ship plates, which continue to be purchased in large quantities by Tyne shipbuilders, can be obtained for £8 10s. per ton, and angles for £7 15s. per ton, less the usual commission; bars are sold by merchants at £7 10s. to £7 12s. 6d. Manufacturers here seem to have undiminished faith in the future of the iron trade, for the rolling mills are all kept fully employed. The forgers in the district are very busy, mainly with heavy ship work, and prices are regarded as satisfactory. Rivet manufactures also are in possession of orders sufficient to keep them going for some months to come. Activity still prevails in the iron shipbuilding yards, where heavy supplies of iron are being received and speedily worked up, but some of the firms are yet complaining of a tardy delivery. Launches have been numerous in the past few weeks, and in nearly every case new keels have been laid in the vacant berths. Engine works and boiler yards continue brisk, overtime being worked at some of them. Extensions are being carried out at some of our manufactories in this important branch of the iron industry of the Tyne; Messrs. Black, Hawthorn and Co., of Gateshead, have been making additions to their works, which are nearly completed. At Sir William Armstrong and Co.'s engine and ordnance works at Elswick, there is a great amount of work being carried on in every department. Copper and lead works maintain the improved condition of things that prevailed during the winter months. In our coal trade there is little change since last week. Shipments continue very steady to all parts of the world except the Upper Baltic ports, which are not yet clear of ice. There is a quietness in the steam-coal trade, and the full advance made on the 1st of April is not so firmly established as was at the time expected would be the case. The best qualities, although nominally quoted 10s. per ton, can be obtained with little difficulty for immediate shipment at 9s. 6d.; but to negotiate forward contracts higher prices have to be given. The collieries in the steam-coal field are working regularly, but there is no pressure, nor is there likely to be until the Baltic trade is in full operation. Gas-coals are in fair demand for the season, the falling off in the London shipments being compensated for by the improved sale for manufacturing purposes. House-coals do not improve, and prices are scarcely quotable. Chemicals remain quiet, but there has been a little more disposition to purchase. Soda ash is rather dearer, and bleaching powder has risen about 5s. per ton since last week. Quotations for some of the leading articles are:—soda ash, 48 to 52 per cent., 1⅜d., less 3½ per cent.; bleaching powder, £6 15s. net; refined alkali, 52 per cent., 2d., less 2½ per cent. Fireclay goods are in strong demand, both for export and for home use. The best bricks sell freely at 50s. per thousand, and secondary qualities at 45s.; retorts, 5s. per running foot; tiles and lumps, 25s. per ton; other articles according to specification. Manufacturers show little disposition to enter into bargains for forward delivery, as it is believed that the continued activity of all branches of the iron and other trades in which furnaces are in constant use must tend to send prices up. There is nothing fresh to report in connection with the glass manufacture.

NORTH LINCOLNSHIRE.—The past week has been one of the most exciting periods which has been witnessed in North Lincolnshire during the past twenty-eight years, but its effect upon the trade has not been so marked as might be expected. The election for the district has been intimately connected with the iron and ironstone trades, so largely carried on in the county. Mr. Rowland Winn, one of the successful candidates, is the owner of vast tracts of ironstone as well as of considerable property. It will therefore be readily conceived that the contest has been naturally connected with business, which is in much the same position as when last noticed. The whole of the district furnaces are in blast, save one at the Frodingham Works, and two which are in course of erection at the Trent Works. The output is much larger than it has been for some years, and the employment of labour greater than for some time past. Some good orders are in hand, and the railway company are carrying a large tonnage of pig-iron from the various works. The demand for ironstone shows no falling off, and in addition to home requirements a good deal is sent to various parts of the country for the use of the furnaces there. North of England coke continues to be largely used in the manufacture of iron; although the tonnage rates from Durham are much higher than from South Yorkshire, by far the largest quantity is drawn from that district. South Yorkshire makers are however doing all they can to improve their coke and are largely increasing their output. New ovens are being erected on every hand, and hopes are entertained that a brisk demand will be experienced.

NORTH STAFFORDSHIRE.—There is nothing new to report with regard to the finished-iron trade in this district. The Birmingham quarterly meeting was attended by numerous representatives of North Staffordshire, but the business done was limited, and as no reduction in prices was declared, it is difficult to speak of the course trade is likely to take in the early future. There is, however, a strong belief in a revival setting in before long, and this feeling is founded upon the indications already referred to of a resumption of the demand for the United States, and upon what are thought to be signs of improvement in the general trade of the country. The current demand for finished iron almost reached the low level existing at the worst period of the late depression, and, but from orders booked some time ago, the mills and forges would now be badly off. Prices are considerably easier, and unmarked iron is being sold at greatly reduced rates. A good many inquiries are in the market, and no doubt a fair proportion of them will be booked by local makers, but competition is so keen that this is only to be looked for with any confidence in the case of specifications of North Staffordshire brands. The demand for pig-iron has fallen off very much of late, and prices are drooping. The same remark applies to ironstone. The coal trade is duller than it has been for several weeks, and a movement in the direction of reducing wages has already commenced, although it will not probably become general until it is seen how the future is likely to shape itself. At the Hanley and Bucknall Colliery wages have been reduced ten per cent., and the example will possibly be followed at some other places, unless business improves.

SHEFFIELD.—There is little fresh animation to report in the heavy trades of the town; and it is evident that many contracts are being kept back pending the result of the elections, when fully decided. Trade has suffered severely through the political disturbances, and it will be some time before commercial affairs again run in their ordinary channel. Bessemer steels have fallen rather heavily on the market, but there are again signs of a revival. A lot of 100 tons No. 1 quality ingots on Wednesday morning, realised £10 per ton, showing a recovery of 10s. per ton within a fortnight. Another very important feature is that coke is going up rapidly, and is firm at the following rates, delivered in Sheffield, local made 22s. 6d. to 24s. per ton; North-country 28s. to 29s, 6d. Two months ago, coke was 15s. per cwt. cheaper. There is a daily increasing call for better class steel, as in some branches of the local staple trades high-class articles are in fair demand. File manufacturers are again very busy and in some departments of the trade the men have secured an advance of wages; the manufacturers having given this on the first solicitation. File manufacturers are therefore ordering large quantities of better steel ingots, and as stocks of the latter during the past four months have been reduced the steel trade must benefit. Indications at present are that the trades of Sheffield, both heavy and light, are likely to improve. Enquiries which are coming from Australia, the Levant, West Africa and India, point to a stiff trade in those directions during the summer months; but the Levant market is excited and for present uncertain. American orders for best cutlery, edge-tools and files are coming in rapidly, and some houses in those lines are busy on their account. Inferior goods for the States are not required. A stiff competition in the table-knife trade is taking place with American makers, but highest class goods are selling well across the Atlantic notwithstanding the high tariffs. The coal market is dull and prices are rather going downwards, with a very flat business doing. The general symptoms of business hourly point to a speedy recovery in the heavy and hardware branches.

SOUTH STAFFORDSHIRE.—Steady employment exists in the chief branches of the hardware trades, still the businesses are by no means free from complaint by masters. It is satisfactory that the Scotch trade is decidedly improved and that the manufacturing districts in the north and north-west of England, are likewise a little better customers. It is the foreign trade, however, that since the year opened has shown the most revival. This week the New Zealand mail has been delivered but the orders which it has brought are hardly so numerous as had been expected. Private advices attribute this to the heavy stocks which are upon the New Zealand market. The lock trade is upon the whole quiet, though here and there makers are doing a large business in iron cabinets, iron pads, and best mortise locks. Manufacturers' stocks are unusually heavy, but these will decrease as the building season advances. The hollow ware people are more active, and enamelled wares, mainly for culinary purposes, are in well-sustained enquiry. An increased trade is being done from Wolverhampton in enamelled sign plates of various descriptions. Finished-iron makers are receiving a few more orders now that the quarterly meetings have been held, and the prices accepted are those quoted upon quarter day.

WEST CUMBERLAND.—The position of the iron trade of this district may be briefly summed up as being, on the one hand industrially active, and on the other hand, so far as new orders are concerned, very quiet. It was shown at the quarterly meetings held last week that hematite, in common with other descriptions of iron, was not in demand. Indeed sellers did less business by far than when they had not nearly so many of their furnaces in blast. Holding, as they do, large orders for delivery over the whole of this year, makers are not pressing their iron on the market feeling assured, that so soon as certain influences now affecting the market have been removed, orders for iron and steel will be placed by Continental buyers and by consumers in various colonies. At present the American demand is very quiet, and the market there is said to be stocked. Large cargoes of metal have to go to America from this district during the year on account of contracts already entered into, and it is more than probable orders from this continent will be given to supplement those already in hand. There is on every hand an indication that the value of iron is declining, and it is observable that those makers who are most fortunately placed with orders are declining at present to quote for forward deliveries. The mining industries in the Cleator district are very actively employed, and raisers of the raw material are pressed for deliveries although they have taken every means of increasing the output. There is a weaker tone in prices and sales have lately been made at from 22s. to 28s. per ton at the pits for average samples. Finished-iron is still in great request, and makers are busily employed with all their mills, which are still working night and day. New features are being introduced into the character of the products of the finished-iron mills of the district. Angle and T iron will soon be produced, while at local steel works there is an increased production of steel plates. The coal trade is quiet, and no improvement can be noted in either the Irish demand or the consumption of the district.

A meeting of the shipyard helpers on strike on the Wear was held at Sunderland on Wednesday, with the view of securing uniformity of action. An early settlement of the dispute is expected.

CONTINENTAL MINING AND METALLURGY.

THE general opinion of the Continent is that the present lull in business is attributable both to over-production and over-speculation, but more to the latter cause than the former. The hopes that were formed of a recovery in April have not, so far, been justified, and we have little doubt that the end of June, the end of the business year in many parts of the Continent, will be quietly waited for before any fresh movement is inaugurated. A consolidation of business is very likely to be the result of the present calm.

France.

Business is said to be good in Paris, at 255 fr. (£10 4s.) for merchant irons and 265 fr. (£10 12s. 6d.) for beams, but we have heard of buyers clubbing together for a joint order and getting terms lower by 20 fr. Plates are in demand in Paris, and fetch £12 16s.; the Paris Gas Company has just placed with Schneider, of Creusot, a very large order for plates for the construction of huge gasometers at the new gas-works at Clichy. The company is a great consumer of plates, both common and boiler qualities. Gouin (Société de Construction des Batignolles) is, according to *La Metallurgie*, building locomotives for Brazil. In how many English counting houses could be found clerks to send out specifications in Portuguese or even in French? The Grenelle Forge is busy in the conversion of Bessemer metal from Bességes into tool steel. Foreign pig is coming more freely into the country, but it is likely to be met by the native article, a fall in which is thought probable. Importation warrants for foundry pig are at 10 fr. Certain Nord Forges are said to have done business lately at 235 fr. (£9 8s.); the report, however, may have been spread by interested persons. In Meurthe and Moselle, as in Haute-Marne, pig is not too plentiful, but the decline in Scotch and English pig has alarmed makers in the East of France. In Haute-Marne castings are selling freely, especially builders' castings, and the point and wire mills are fully occupied.

From the Loire news continues good. Prices are firm, every one is at work, there is no anxiety as to the future, industrial shares have gone up and keep up. The two dephosphorisation works owned by De Wendel are going to "throw floods of metal on the market," says the *Journal des Mines*, which makes reference to the famous contract for 70,000 tons of metal for which De Wendel has engaged with the Eastern of France. M. Montgolfier, the manager of the Aciéries de la Marine, is stated by the same journal to have acquired the right to make Thomas metal at the important works under his care. The blast-furnaces of Balaruc will shortly be fired, the coke is to come from Graissessac. At Le Vignan several deposits of calamine and other ores have been discovered.

The charcoal irons made in the Limousin have less competition to support on the part of the steel irons of the Ariége, and the standard rate has been raised from £14 to £16 at the works. These irons are a favourite material for the manufacture of agricultural implements. In the Ardennes scrap is reported to be falling: crop ends are quoted at 115 fr. (£4 12s. 6d.), and do not find takers.

The following is an extract from a report of M. Callignon to the Paris Société d'Encouragement:—"The problem of getting rectilinear motion from rods receiving a circular movement, a problem approximatively solved by Watt in his parallel motion, was long thought incapable of an exact solution. This has been found not to be the case. Colonel Peaucellier brought out, a few years ago, an articulation named by him a 'reciprocator,' which effects the transformation desired by means of reciprocal vectors. In this apparatus there are seven rods, the top part of the apparatus describes a straight line while another point describes the circumference of a circle. This elegant solution of Watt's problem was also proposed by Lipkin, of St. Petersburg, a little after Peaucellier's discovery. The attention of geometers having been drawn to the point, numerous studies on it have been published. The primitive seven-rod reciprocator was soon improved, and a five-rod apparatus based on the isosceles trapezium furnished a second solution of the problem. A third has been brought out by M. Perrolaz, of Thonon (Haute-Savoie). It is derived from that enunciated by Peaucellier, and is substantially a regrouping of the same pieces."

The Paris coal market is dull both for home and manufacturing sorts. Of the latter the stock on hand is ample, for the former the demand is almost limited to the restaurateurs. In the Centre extraction is tolerably brisk. In certain collieries in the department of the Gard, and particularly at Bességes, says *Le Charbon*, the viewers are paid a month extra at the end of the year, if there has been no loss of life or accident at the colliery during that year. At Bességes, with 2500 miners and an output of 450,000 tons, there was no accident during 1879. The same company pays half the life-assurance premiums of its engineers.

The Paris Gas Company made in 1879, 218,813,875 cubic metres of gas, 7,000,000 more than in 1878. At 30 centimes the cubic metre, the company earned nearly £2,250,000. The coke made fetched £520,000, tar £104,000, chemical products £46,000, ammoniacal waters, £14,640. The gross profit were £1,256,000. Of this £496,000 goes direct to the company, the remainder being shared between the company, the remainder being shared between the company and the city. The dividend for 1879 was 65 fr. 50, that for 1878 was 65 fr.; that for 1879, 62 fr.

Belgium.—The market is better than it was a month ago, and orders are beginning to flow in again. For beams inquiries are numerous, and the rail mills (iron) at Charleroi have work to last them up to December. Split irons are weak, the last quotation was 187 fr. 50 f.o.b. Antwerp, and at this no business could be done. A provisional credit of half-a-million sterling has been voted by the Chamber on account of public works, and M. Sainctelette may now permit specifications to be sent in for the 2000 railway vehicles with which Belgian manufacturers are so anxious to benefit the State. American orders are scarce. The Brussels *Intérêts* learns that the Liége syndicate is about to send an engineer to South America, "to continue the exploration of its various countries, which offer a vast area of consumption for Belgian manufactures."

The Cockerill Company has completed the metallic part of the fabric in which will be held the National Exhibition, the 6187 tons of metal which it had to put into shape and into place are now in shape and in place. Work has gone on all through the winter—the first girders being placed October 28th, 1879, the whole structure being up by the 1st inst. The Cockerill Company will exhibit, according to the *Intérêts*, a more complete and varied assortment of its products than even in 1878.

In defending the management of the State railways, M. Sainctelette drew attention in the Chamber of Representatives on the 9th inst. to the greater frequency of railway accidents during periods of severe frost. A member of the Chamber stated that in December last the Eastern of France had more rails broken than during the whole of the ten previous years. In 1878 the accidents on Belgian lines were 172 in number, in 1879 they rose to 279, 80 of which took place during the last quarter of the year. It would be interesting if these accidents could be particularised with observation of temperature, nature of rail, and nature of superstructure. Numerous branch lines are to be completed in Belgium in the course of the present year.

The *Journal de Liége* gives the following *aperçu* of the means existing in 1878 for the production of steel in all the world :—

	Bessemer Converters.	Martin furnaces.	Bessemer steel.	Martin steel.	Steel rails.
England,	107	94	820,000	176,500	690,000
Prussia,	50	42	452,400	50,173	358,000
France,	29	46	283,000		231,500
Belgium,	12	2 ?	115,000	—	?
United States,	25	27	700,000	22,650	543,000
Austria,	32		95,000	5,000	

Only about half the total number of converters and furnaces were at work. The last column should be increased by some 20 per cent. to allow for waste in rolling.

The Belgian coal market has retreated to what may be called the normal position of 8 fr. for pit-coal for manufacturing purposes, and 11 fr. for house-coal, and no further weakening of prices is anticipated. The demand for house-coal at Mons is small, and the collieries are washing and storing in anticipation of next season, but their so doing is not taken as any sign of distress. Of manufacturing coal the supplies on hand are not heavy, and stocks are not being formed. Coke is in good demand, unwashed bringing 28 to 30 fr., and washed 35 fr. (£1 8s).

In connection with the Anderluis catastrophe it has been remarked that it took place at a time of barometrical depression. The explosion took place at 1.45 on the morning of April 1; the barometer attained a maximum depression at about 2.30 the same morning, showing only 741 millimetres. The Brussels *Intérêts* states that at the collieries owned by the Cockerill Company the fan-engine room is provided with an aneroid barometer and a manometer and a direction card —fair weather 75 revolutions, change 80, rainy 85 ; that is, according to the barometrical indications the driver makes 75, &c., revolutions, increasing the ventilation in proportion to the depression. The company introduced this innovation after the accident in 1875 at the Marihaye Colliery.

The accident at Anderluis has given a fresh stimulus to the public interest in the commission named for the investigation of the causes and remedies to be proposed for the prevention of colliery explosions. The questions asked in the Chamber of Representatives have not met with a very satisfactory answer, but M. Sainctelette stated the proportion of deaths by colliery accidents during the past ten years to have averaged 2·27 per 1000 in Belgium, 2·43 in France, 2·57 in England and 2·86 in Prussia, so that at least Belgium was not worse off than other countries in which the "dreadful trade" of coal mining is carried on.

The "gros lot" in the Franco-Spanish lottery has been won by a lucky collier named Voituron, employed at the Mambourg Colliery, Belgium. It is worth £6000.

On the 12th was buried M. Arthur Warocqué, manager since 1868 of the Mariemont and Bascoup Colliery Companies. Deceased was born at Morlanwelz in 1835. He received the curious eulogium that he was a Belgian "comme on en rencontre trop peu—un Belge qui savait être riche."

GERMANY.—The Statistical Bureau has published returns of the mining industry of Germany during 1879. The ironstone raised was 5,822,286 tons; the make of pig-iron 2,161,192 tons; foundry pig, 130,700 tons; Bessemer pig, 473,056 tons; forge pig, 1,532,826 tons; malleable iron and steel, 1,114,990 tons; ingot iron and crucible steel, 492,512 tons; coal, 42,631,729 tons. Compared with 1878 there was an increase in the output of coal of 6·17 per cent.; of ironstone, 7·80 per cent.; of the make of foundry pig, 20·19 per cent; Bessemer pig, 7·32 per cent.; malleable iron, 2·61 per cent. Values in foundry and Bessemer pig showed a slight increase; common pig and coal a slight fall.

Trade is uncertain ; prices are nominal and fluctuating ; and although there are no signs of distress and hopes are frequently expressed of a speedy return to a solid and satisfactory state of business, that state has yet to be realised, and the present period of transition is uncomfortable. Boiler plates are taken freely and rail mills and engineering works are fairly supplied with orders, but new business is scarce. On the 9th the Laurahütte, a Silesian concern, tendered for 9500 tons of rails for the Oder railway at £10 10s. This was the lowest price tendered ; the highest was £13.

For welding cast steel the *Deutsche Industrie Zeitung* (April 7th) recommends a powder composed as follows :—

1 atom boran	=	191·32	or in 100 parts 61
1 „ sal ammoniac	=	54	„ „ 17·25
½ „ prussiate of potash	=	52·2	„ „ 16·75
5 „ colophonium	=	15·67	„ „ 5

This receipt was sold by a workman from the Palatinate some thirty years ago. Taking the reactions into account which take place when sprinkled on the heated metal, the following mixture is proposed, as being of equal value and more easy to prepare.

41·5 parts boric acid.
35·0 „ pure dry chloride of sodium.
15·5 to 26·7 „ prussiate of potash.
3 to 5 „ dry carbonate of soda.

The Hanover Stokers' and Engine Drivers' School, opened in 1873, the first of its kind in Germany, continues to enjoy a remarkable success, and to be the means of doing great good among journeymen "engineers." The lectures for 1879 were attended by 258 students, of whom 159 went in for examinations at the end of the year's course. The instruction given is strictly practical and direct.

AUSTRIA.—In the *Oest J. f. Berg- pp. Wesen*, Mr. C. Ernst reports on the Austrian market for March in the following terms :—The hurrying-up of prices for iron and steel come to a stop during March, but there is no diminution of confidence in the future of the market. Indeed, it is the belief of many that a new movement forwards will take place as soon as the weather grows warm. The spring will have its usual contingent of special orders, there will be a new building season, the rivers and roads will be open, and there are new lines of railway to build. These will give the tendency to improvement which already exists a powerful onward impetus. The situation of our works is satisfactory, and both the blast-furnaces and the forges hope for better times when their present contracts, some of which are not very profitable, have run out. The market for bars is turned upside down by the action of speculators, who are now forced to realise ; it is impossible for the mills, in spite of their firmness and unity, to undo the mischief thus caused. This has hindered very much the normal development of the trade in merchant irons. Plates, sheets, and machinery iron are steady, and foreign orders have been booked by Syrian steelworks, Bohemian engine and boiler makers, and steelworks in Carniola and Carinthia. The railways are actively turning out their old rails, and have "got good prices for them."

NEW PATENTS.

ALL the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 1393 to No. 1503, being the entries from April 6th, to April 12th.

NEW APPLICATIONS.

Absorption of Noxious Gases.—*H. P. Boulnois, Exeter.* [1461
Air-tight Capsules for Bottles.—A communication.—*S. P. Wilding, London.* [1459
Apparatus for Drawing Corks, &c.—*F. W. Russell, London.* [1480
Bank Cheques, &c.—*R. Evans, Newcastle-upon-Tyne.* [1468
Beer.—*A. W. Gillman and S. Spencer, London.* [1471
Bicycles.—*E. H. Hodgkinson, London.* [1425
Bicycles.—*H. Clarke, Wolverhampton.* [1452
Blast Furnace Apparatus.—*J. Alexander and A. K. McCosh, Gartsherrie Ironworks, Lanark.* [1433
Boots and Shoes.—A communication.—*J. H. Johnson, London.* [1436
Boots and Shoes.—*G. Pearman, Henley-on-Thames, Oxfordshire.* [1443
Brewing Apparatus.—*J. Barton, Dewsbury, Yorkshire.* [1444
Burning of Clay.—A communication.—*J. G. Wilson, Manchester.* [1399
Breechloaders.—*J. Lang, London.* [1422
Caloric Engines.—A communication.—*C. D. Abel, London.* [1414
Card Grinding Machines.—*J. S. Dronsfield, Oldham.* [1415
Card Shooter.—A communication.—*J. Bock, London.* [1453
Cartridge Cases.—A communication.—*W. E. Gedge, Strand, London.* [1448
Castings.—*G. Whalley, Keighley, Yorkshire.* [1494
Churns.—*W. Earle, Philadelphia, U.S.A.* [1423
Clasp Knives.—A communication.—*C. Kesseler, Berlin.* [1500
Clothes Linings.—*T. N. Mapleston, London.* [1411
Coal Gas Manufacture.—*W. Mann, Gunnersbury, and W. T. Walker, Highgate, London.* [1478
Coal Tar Manufacture.—*C. Lowe and J. Gill, Manchester.* [1456
Cocoa-Nut Oil.—*A. P. Ashbourne, Boston, U.S.A.* [1498
Combing Fibrous Materials.—A communication.—*T. Gaddum, Manchester.* [1460
Cork Drawing Apparatus.—*R. H. Berkeley, Birmingham.* [1438
Crank Shafts and Axles.—*T. Turton, Liverpool.* [1431
Crop Binding Machinery.—*W. Woolnough and C. Kingsford, Kingston.* [1417
Cutting Wool Burs.—A communication.—*H. Simon, Manchester.* [1430
Dark Lanterns.—*P. B. Bicknell, Lincoln.* [1497
Decorators.—*E. J. Couty, Paris.* [1446
Distillation Products from Wood.—*R. Haldane, Glasgow.* [1435
Draught-Protector for Lamps.—*C. Reimers, London.* [1455
Dyeing Apparatus.—*A. Lyon, Paris.* [1467
Economising Heat in Furnaces.—*A. H. Hearington, Rochester, U.S.A.* [1432
Electric Conductors.—*O. Heaviside, London.* [1407
Electric Lamps.—A communication.—*C. D. Abel, London.* [1397
Endless Bands.—*C. Hodgson, Bilbao, Spain.* [1458
Feed-water Heater.—*J. McNeil, Greenwich, Kent.* [1437
Filters.—A communication.—*C. D. Abel, London.* [1402
Fruit Beverage.—*A. J. M. Bolanachi, West Dulwich.* [1462
Fuel-Feeding Apparatus.—*W. Garner, Salford, Lancashire.* [1413
Glass Furnaces.—*R. Paul, Glasgow.* [1474
Graduated Glasses.—*J. G. Sowerby, Gateshead-on-Tyne, Durham.* [1449
Greenhouses, &c.—*A. S. Nixon, Kettering, Northamptonshire.* [1447
Grinding Mills.—A communication.—*W. Morgan-Brown, London.* [1472
Hammer-closing Staple.—*T. J. Hovell-Thurlow-Cumming-Bruce, Thurlow, Suffolk.* [1410
Hat Brims and Bands.—A communication.—*H. J. Haddan, London.* [1490
Hydraulic Lifts.—A communication.—*J. A. Berly, London.* [1487
Hydraulic Presses.—*J. Bennie, Glasgow.* [1429
Illuminating Gratings.—*T. Hyatt, London.* [1499
Improvements in Tops of Tables, &c.—*W. Schofield, Clapham.* [1483
Iron and Steel Manufacture.—A communication.—*W. R. Lake, London.* [1479
Knitting Machinery.—*F. D. Poulter, London, and E. Attenborough, Nottingham.* [1424
Labels for Railway Carriages.—*J. Elliott, Leeds.* [1442
Light and Heat.—A communication.—*P. Jensen, London.* [1476
Lighting Lamps.—*J. Hinks and J. Hinks, Birmingham.* [1396
Looms.—*C. Brigg and T. H. Brigg, Bradford.* [1418
Looms for Fancy Fabrics.—*J. Hamilton, Strathaven, Lanarkshire.* [1465
Mangles, &c.—*W. B. Dick, Langley Mill, Nottinghamshire.* [1439
Manufacture of Bread.—*A. Esilman and J. H. Hassall, Manchester.* [1493
Metal Vessels.—*T. Harding, Bristol.* [1477
Millstone Ventilators.—A communication.—*W. A. Barlow, London.* [1481
Money Till and Check.—*E. J. J. Comer, B. Walton, and B. Andrews, London.* [1304
Moulding Apparatus.—A communication.—*J. H. Johnson, London.* [1451
Music Printer.—*H. V. Dickinson, Newbury, Berkshire.* [1496
Nose-bags.—*H. Langsford, London.* [1412
Oil Soot.—A communication.—*G. W. von Nawrocki, Berlin.* [1420
Paper Cutting Apparatus.—*H. M. Nicholls, London.* [1485
Permanent Way.—*J. Livesey, London.* [1473
Perpetual Motion.—*W. Barrett, Prestbury, Cheshire.* [1401
Ploughs.—*R. Hancock, Ilfracombe, Devonshire.* [1486
Portable Book Holder.—A communication.—*W. R. Lake, London.* [1427
Preparation for Treating Sheep, &c.—*W. H. Heard, Tavistock, Devonshire.* [1450
Preparation of Printing Surfaces.—*J. J. Sachs, Manchester.* [1419
Printing Presses.—A communication.—*P. M. Justice, Southampton Buildings, London.* [1454
Production of Oxygen and Nitrogen Gas.—A communication.—*P. Jensen, London.* [1416
Railway Carriage Couplings.—A communication.—*W. E. Gedge, Strand, London.* [1495
Railway Rolling Stock.—*I. A. Timmis, London.* [1464
Reaping Machines.—*M. A. Thompson, Berwick-upon-Tweed.* [1406
Refrigerators.—*A. S. Haslam, Derby.* [1484
Reed Organs.—A communication.—*W. R. Lake, London.* [1403
Rotary Motion.—*L. O. Michael, Bristol.* [1409
Sanitary Appliances.—*C. T. Brazier and C. Brazier, Blackfriars Road, London.* [1441
Saw-Sharpening Machinery.—A communication.—*A. M. Clark, London.* [1428
Scissors.—A communication.—*C. Kesseler, Berlin.* [1502
Screw-Cutting Machines.—A communication.—*A. J. Boult, London.* [1426
Seed Cleaning Machinery.—A communication.—*J. A. A. Buchholz, London.* [1463
Shipbuilding.—*J. A. Novello, Genoa, Italy.* [1408
Silk Glazing Apparatus.—*A. Lyon, Paris.* [1470
Spade Handles.—A communication.—*W. R. Lake, London.* [1440
Spot Yarns.—*G. A. J. Schott, Bradford.* [1393
Spoons and Forks.—A communication.—*W. R. Lake, London.* [1421
Stamping Machine.—*L. Engel, London.* [1395
Steam Engines.—*K. W. Jurisch, Ph.D., and J. H. Lewis, Widnes Lancashire.* [1488
Steel and Iron Manufacture.—A communication.—*W. A. Barlow, London.* [1482
Steel and Iron Manufacture.—*J. H. Wilson, Liverpool.* [1400
Stoppers and Caps for Bottles.—*A. R. Stocker, London.* [1404
Street Cabs.—*T. Greenhill, London.* [1469
Swimming Apparatus.—*A. Graf, London.* [1466
System of Publicity.—*J. C. Callot, Paris.* [1445
Telegraphic Cables.—A communication.—*F. Wirth, Frankfort-on the-Main, Germany.* [1475
Tip-Trucks.—*S. Geoghegan, Dublin.* [1405
Tobacco.—*A. Prior, Dublin.* [1457
Twisting Machinery.—*J. Farrar, Halifax, Yorkshire.* [1398
Type Matrices.—*G. D. Macdougald, W. Adie, G. R. Adams and P. Fleming, Dundee.* [1503
Unloading Vessels.—*B. B. Campbell, Dublin.* [1501
Vitreous Mouldings.—A communication.—*J. Imray, Southampton Buildings, London.* [1491
Waterclosets.—*J. Shanks, Barrhead, Renfrewshire, and W. Sim, Glasgow.* [1492
Weighing Machines.—*J. Carr, Bradford, Yorkshire.* [1489
Wool.—*J. F. Harrison, Bradford.* [1434

COMMERCIAL.

THE IRON TRADE.

THOSE who are concerned in the production and consumption of iron are not a little perplexed by the downward tendency of prices, and by the slackening of the American demand, which was confidently expected to keep up at least throughout the whole of the present year. The outlook, indeed, is full of uncertainty, and naturally enough much anxiety is manifested to gauge it aright, and so anticipate the requirements of the future. The revival of industry on this side of the Atlantic, says *The Times* of Wednesday, has been largely due to the demands from the other side, and it is believed in many well-informed quarters that those demands will not materially decline for at least six or eight months to come. But the latest aspects presented by the American markets are by no means reassuring to English industrials. The official organ of the American Iron and Steel Association, in a recent issue, set forth that after the 1st of the present month America would be "equal to supplying her own demands in all lines;" that "in bars, plates, sheets, hoops, nails, agricultural and other steel, and pig-iron the demand from all sources is practically already met;" and that many furnaces that were idle during the period of depression have already been got to work, while others are preparing to follow. The most that the Americans lead us to expect is that they may during the present year take from us about 100,000 tons of railway iron, towards completing the 1,500,000 tons which they reckon on using in the renewal of their existing railway system of 83,000 miles, and in laying about 7000 miles of new tract. This, however, would only be a drop in the bucket compared with the consumption for which the iron and steel manufacturers of this country are preparing and hoping.

The unemployed resources for the production of iron brought into operation within the last six months are probably greater than have ever been before called into use within a similarly short period. In America the number of furnaces blown in between July and December last is ascertained by the *Iron Age* to have been 127, bringing up the total number in use to 384, or a larger number than was found working at any time during the preceding seven years. These 384 furnaces are equal to producing 4¼ million tons of pig-iron per annum, which is nearly a million and a half tons more than America has yet produced in any one year. But this is by no means the maximum production of which America is capable, for 293 furnaces were out of blast at the same time that these 384 were in operation, so that a formidable reserve is still available. When we add that America has never yet consumed much over three million tons of pig-iron in any one year, it will at once appear that her present ratio of production is likely to be fully abreast of all her own requirements. It is true that during the last three months the United States have taken a great deal of pig-iron from England, but much of that iron was intended to meet a demand that was more speculative than *bona fide*, and this to some extent accounts for the depreciation of value recently witnessed.

Statistics collected within the last fortnight show that in the United Kingdom 141 furnaces have been blown in since the 1st of November. Of that number, ninety-seven are in England, twenty-two in Scotland, and seventeen in Wales. These 141 furnaces are equal to producing 2,099,600 tons of pig-iron per annum—a quantity exceeding the whole annual production of France, and almost equal to that of Germany. Cleveland alone is now turning out pig-iron at the rate of 2,270,800 tons a year, equal to an increase of more than a quarter of a million tons on the production of 1879. When we add the increased ratio of production in England and America together, we find that they aggregate about 3½ million tons. No such increase as this has ever before occurred. It is calculated that between 1871 and 1872 the production of pig-iron throughout the world increased from 12,565,000 to 14,445,000 tons, but of this increase Great Britain only contributed 114,000 tons, and the United States 740,000 tons, the remainder having been supplied by Germany, Luxembourg, Belgium, France, &c. All of these countries, as well as our own, have now been stimulated by the prospect of remunerative prices to develop their production, and, although there are not available for them the same exact figures as those quoted for the United States and England, it is sufficiently well known that the increased resources brought into operation have been very considerable. Bearing all this in mind, it need excite no surprise if the decline that has recently taken place in the price of iron should not only continue, but proceed in an accelerated ratio. Should the present rate of production be maintained, it is difficult to understand where a market is to be found for so much iron. The analogy of past experience does not guide us to a satisfactory conclusion on this question, because the high prices of 1871-72 induced several countries that were formerly among our best customers to increase very largely their means of production. English enterprise, of course, is constantly seeking for and opening out fresh markets; but even if these markets should fully repair the deficiencies of demand in the case of older customers, and thus prevent any absolute decline of our production, it is not to be expected that they will call for the enormous balance now being created in favour of supply. Over-production, in short, is again threatened. Such a result was almost inevitable from the large producing plant inoperative when the revival set in, and from the suddenness with which prices were increased. Of the 950 furnaces erected in Great Britain, only 458 were in operation during October last, so that 492 furnaces were unproductive. Ironmasters had great and perhaps irresistible inducements to call this costly and idle plant into activity when they saw hematite iron increase 150 per cent., Scotch pig-iron 70 per cent., Cleveland iron 61½ per cent., and Lincolnshire iron 76½ per cent. within three months. That these advances have not been maintained is, of course, due to the fact that more and more iron has been thrown upon the market until something almost approaching a glut has been produced. At the present time, however, manufacturers have little reason to complain. They will not suffer much hurt if prices do not fall below their current level, and they will have reason to congratulate themselves if the state of trade continues such as to enable that level to be maintained.

In the same number of *The Times*, Mr. James Shaw, of the Cwm Avon Iron and Copper Works, repeats the warnings against over-production and speculation which he urged in the beginning of the year. Mr. Shaw says:—"The immense power of production suddenly brought into play has swamped the powers of consumption, great as these have been; and a demand, which was quite as much a gigantic speculation as a substantial reality, having subsided, prices have collapsed to a most extraordinary extent. For instance, Scotch pig-iron, which was 73s. per ton, has fallen to 55s.; hematite pig-iron, which was 140s. per ton, has fallen to 90s.; coke tinplates, which were 32s. per box, have gone down to 20s. per box; and other articles in which speculation was rife have fallen in proportion. Bar iron, ship plates, and angle-iron, and other classes of iron which were free from the touch of speculation, have almost maintained the highest prices they reached. Parcels of iron in the hands of the speculators have been forced upon the market faster than merchants and consumers could absorb them, and the serious fall referred to has been the result. The Board of Trade returns for March show that great strides in shipments of all sorts of iron have been made; but, even in face of these, buyers were timid, and bought reluctantly during the rapid fall. These secondhand parcels are now almost cleared out, and what may now be expected to follow? In a few brief words simply this—further extension of production will cease, prices which have now reached a safe and reasonable as well as a fairly remunerative limit will encourage consumption and enterprise, and a solid, healthy state of business will supervene. Business has to some extent been disorganised by the elections, but these will soon be at an end, and the mercantile world will be reassured by having, at any rate, a strong Government. There is a wonderful parallel between waves of commercial and political excitement. Perhaps, as a defeated candidate in the great political strife, my views may be tinged by recent events. The commercial mob takes a fever, and for the time it is irresistible. It may be iron, cotton, or corn, railway shares, mining shares or water shares, but while the seizure lasts it is omnipotent. The iron trade has just passed through one of these, and the effect will be to induce a greater spirit of moderation than has hitherto prevailed. With peace abroad, a good harvest in Europe and good government at home, the prospects of the iron trade are excellent, and we may confidently look forward to a good summer and autumn trade, when the prices which have recently been reached will again be paid, not as the result of excessive speculation, but of sound trade overtaking the increased production called into existence."

J. BERGER SPENCE AND CO.'S WEEKLY REPORT.

CHEMICALS.—There has been no indication during the week of a return to activity in the chemical markets, and the course of business has been slow and unsatisfactory. The public mind is still too disturbed by politics to devote a fair meed of attention to trade, and where this is not actually the case there is a strong disposition among consumers to wait before operating until they can judge of the probable influence of the new state of things political. This, of course, is barely complimentary to the powers of the Government Opposition, but doubtless it were too much to expect it to inspire the country with the same confidence in the future of trade it professes to feel. The range of prices still tends towards weakness, though nominally there is no alteration. Sellers, however, particularly those holding stocks, evince their eagerness to quit by holding out inducements to probable buyers. This has been prominently the case during the week. The inquiry from the Continent has also weakened slightly, and although a steady trade continues with America, it is sustained with more difficulty. The Board of Trade Returns in reference to the exports of alkali during March are satisfactory. There were 29,335 tons, of an estimated value of £219,305, exported, against 27,636 tons, valued at £175,818, during the corresponding month of last year. The figures show an increase in quantity in favour of the former month of 6·2 per cent., and of 24·7 in value.

MINERALS.—There is, as yet, a considerable amount of quietnes observable in respect to minerals. It may be only of a temporary character, but nearly every article in the category has suffered in value since the commencement of the month, and as far as appearances show, there is no immediate prospect of a return to activity. Consumers display more cautiousness in the extent of their purchases, and are not quite so eager to cover their probable forward requirements. Iron ore rather decreases in demand, and business is more difficult to arrange at full prices. Supplies are now over plentiful, and it requires considerable care to avoid the accumulation of stocks. Brimstone is easier and weaker. Parcels for forward delivery are being offered on lower rates, cheaper freights being anticipated. Copper and lead ores and blende are cheaper. China clay is in rather good request.

METALS.—The reports to hand during the week show some slight disposition to improvement in the pig-iron trade, although the quarterly meetings have been rather disappointing, and have by no means realised the expectations formed in respect to them. However, since the beginning of the week, Glasgow warrants have secured a firmer position. Quotations have advanced somewhat, and still tend upwards, though there are yet parcels to be obtained at the lower figures from nervous or needy holders. At Middlesborough, on Tuesday, matters seemed in a more healthy condition under the influence of the improving state of Glasgow. There was an increase of inquiries, and less pushing for orders, except on sellers' own terms. The stock returns for March are favourable. They show a net decrease of 7133 tons, notwithstanding an increased production on the preceding month of 15,123 tons. Hematites are still dull and inactive, and merchants disposed to quit parcels bought for speculation at the best prices obtainable. Lancashire brands have been neglected. Staffordshire iron is unchanged. Tin has secured a considerable advance; and copper, after some fluctuation, is now rather firmer. Lead remains weak. Spelter continues moderately firm.

GENERAL ITEMS.—It appears that, during 1879, there were in Great Britain 30 explosions of boilers, through which 38 persons were killed and 53 persons injured.

Manchester, April 10th, 1880.

JAMES H. WEAGER AND CO.'S METAL REPORT.

ALTHOUGH the aspect of things in the metal market the past week has presented a phase sufficiently depressed to satisfy the most ardent depreciators for speculative buying, still we are glad to report a gleam of improvement in some descriptions. Tin and copper, which have been changing hands at prices dropping some £4 and £6 per ton since our last, to-day show a decided improvement, and there are layer buyers at an advance of 30s. to 40s. on yesterday's prices. Pig-iron market continues depressed, closing at 51s. 9d. warrant Glasgow manufactured iron. Marked bars hold their advance, but common iron realises according to the needs of manufacturers. We attach present quotations: Lead is stronger; English, £16 15s. to £17; Spanish, £16 10s. Tinplates: makers at present do not seem disposed to pander to the expectations of buyers, feeling pretty confident of better prices. Iron: Bars, Staffordshire, £8 to £9; hoops, £9 to £10; sheets, £10 10s. to £11 per ton. Copper: Chili slabs for 96 per cent., £61; English ingots and blocks; £70 to £73; English sheets, sheathing and rods, £76 per ton; yellow metal sheets and sheathing, 6½d. per lb. Tin: English ingots and blocks, £90 per ton; English bars, 4 cwt. barrels £91; foreign, Straits, £81; Australian, £81. per ton. Tinplates: coke, 22s.; charcoal, 26s. to 28s. per box. Lead: Spanish pig, £16 10s.; English, £16 15s.; bars, £17; pipe, £17 15s. to £18; sheets, £17 10s.; shot, £20 10s. per ton. Zinc, £23 10s. Antimony, £71 per bottle.

26, Leadenhall Street, E.C., April 15.

ALLNUTT AND WOOD'S IRON FREIGHT REPORT.

RATES of freight show very little alteration, but there is less demand for speculation. Merchants confining themselves to shipping under contracts which they have on hand. Steamers have been fixed, Cardiff to Montreal, for 2000 tons, new rails at 12s. per ton, to load early May; and from Odessa to Philadelphia a charter has been signed at 24s. per ton old rails. For ore cargoes, Bilboa to Antwerp, 13s. 9d. per ton has been accepted for four consecutive voyages, and from Drontheim to Ipswich one steamer at £7 per 21 cwts. ore. Sailing vessels have been fixed, Middlesborough to Philadelphia, at 15s. 6d. per ton. Pig-iron and, for Stockholm, part cargo of iron at 8s. per ton. From Troom to a United States port 13s., and Workington to New York 14s. per ton pig-iron has been done, and from Cardiff to New York 11s. 6d., and 5 per cent. for half cargo of rails and half spiegel. A vessel has been fixed, Cronstadt to New York, at 17s. 6d. per ton old rails.

London, April 14th.

PARTNERSHIPS DISSOLVED.

Lawrence and Porter, Parliament Street, Westminster, engineers.—Hale and Parry, Pensnett, near Dudley, fire light manufacturers.—Monkwood Colliery Company, Monkwood Collieries, near Chesterfield, colliery proprietors.—Nunn, Brown and Co., Northampton, coal merchants.—Morrell and Restall, Birmingham, metal workers.—H. Falcke and R. Angeloni, Great Vine Street, Regent Street, London, manufacturing jewellers.—Vos and Co., St. James's Road, Holloway, cattle food merchants.—Walthew and Suckling, Birmingham, architects.—T. King and Co., Bellside, Motherwell, quarrymasters; as regards H. J. King.—Button and Brocklehurst, ironfounders; Clarke and Pickwell, Kingston-upon-Hull, civil engineers, and Barrow-upon-Humber, brick manufacturers.—G. Moore and Sons, St. John's Square, Clerkenwell, watch manufacturers.—Tenant and Co., Liverpool and Manchester, manufacturing chemists; as far as regards J. Crompton.—Mason Shelmerdine and Co., Llangollen, manufacturers of bricks, &c.; as far as regards J. Travis.—Smith and Jones, Manchester, manufacturing chemists.

NEW COMPANIES.

ALSTON UNITED MINING ASSOCIATION.—This company proposes to purchase a mining sett situate on Alston Moor, in the parish of Alston, Cumberland. It further proposes to purchase other setts for the purpose of carrying on mining operations in the counties of Cumberland, Durham and Westmoreland. It was registered 5th inst., with a capital of £30,000 in £1 shares.

BEDOUIN STEAM NAVIGATION.—Registered 31st ult, with a capital of £150,000 in £100 shares, to carry on the general business of a steamship company.

DEWSNAP AND COMPANY.—This is the conversion to a company of the business of master cutler and metal grinder formerly carried on by Mr. Dewsnap (deceased). The purchase includes interest in leasehold premises, Nos. 57 and 58, St. John's Square, Clerkenwell, fixtures, stock in trade, &c. The company was registered 2nd inst., with a capital of £2000 in £5 shares.

ENSOR AND COMPANY.—This company was registered 3rd inst., with a capital of £15,000 in £5 shares, to take over the business of potters, manufacturers of sanitary ware, and brickmakers, carried on by Messrs. Edward and Henry Loader Ensor, at Church Gresley, in the county of Derby.

INDIAN GRANGE GOLD MINING.—This company proposes to adopt an unregistered agreement of 22nd ult., between Arthur Roberts and Charles George Ernest Terraneau of one part, and Thomas Kemp of the other part, and to acquire and work gold mining properties in India. It was registered 5th inst., with a capital of £100,000 in £1 shares.

PENTRE HALKIN HALL LEAD MINING.—On the 6th inst. this company was registered with a capital of £15,000 in £1 shares, to carry on mining operations in the parish of Halkin, county of Flint.

STEAMSHIP "ENNISMORE."—With a capital of £25,000 in £10 shares, this company proposes to transact the general business of a shipping company.

VINCENT TIN MINING.—This company was registered 1st inst. with a capital of £15,000 in £1 shares, to acquire a lease of the Vincent Tin Mine, situate near Altarnum, Cornwall, with plant and machinery appertaining thereto.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

Metal Market, City, Thursday Afternoon, 4 P.M.

(*April* 15, 1880.)

METALS AND ORES.

	April 8.		April 15.	
COPPER (per ton)—	£ s.	£ s.	£ s.	£ s.
Chili, for 96 per cent.	64 10/	—	61 0/	—
Wallaroo	79 0/	—	78 0/	79 0/
Burra Burra	77 0/	—	76 0/	76 10/
English Tough	72 0/	73 0/	70 0/	71 0/
English Ingot, best	74 0/	75 0/	71 0/	73 0/
Sheets sheathing and rod	78 0/	—	76 0/	—
Bottoms	83 0/	—	81 0/	—
Ore per unit	0 13/9	—	0 13/9	—
PHOSPHOR BRONZE				
Special Bearing Metal (p tn)	116 0/	—	116 0/	—
Other alloys (per ton	123 0/	139 0/	123 0/	139 0/
TIN (per ton)—				
Straits (Cash)	87 0/	—	81 0/	—
Do. for arr.	—	—	—	—
Billiton	—	—	—	—
Banca	—	—	—	—
English Ingots	91 0/	92 0/	90 0/	—
Do. Bars	92 0/	93 0/	91 0/	—
Do. Refined	94 0/	—	93 0/	—
Australian	87 0/	—	81 0/	—
TIN PLATES, per box, I.C. coke f.o.b. London	0 22/	0 24/	0 22/	0 24/
IX. do.	0 27/	0 29/	0 27/	0 29/
I.C. charcoal	0 26/	0 30/	0 26/	0 30/
I.X "	0 32/	0 36/	0 32/	0 36/
LEAD (per ton)—				
Soft English pig	16 10/	—	16 15/	17 0/
Do. W.B.	—	—	—	—
Spanish soft	16 5/	—	16 10/	—
Do. with silver	—	—	—	—
Sheet milled	17 0/	—	17 0/	—
Red lead	17 10/	—	17 10/	—
White	22 0/	—	22 0/	—
Patent shot	20 10/	—	20 10/	—
ZINC (per ton)—from No. 9 Gauge.				
Sheets, rolled	23 10/	—	23 10/	—
Do., foreign	24 0/	—	24 0/	—
SPELTER (per ton)—				
Silesian, com	20 15/	—	20 15/	—
Rhenish	—	—	—	—
English	—	—	—	—
QUICKSILVER, bot.	6 15/	—	6 15/	—
ANTIMONY ore (per ton)—				
Australian	11 10/	14 10/	11 10/	14 10/
Spanish	—	—	—	—
French Star	71 0/	72 0/	71 0/	72 0/
Regulus—				
Crude (per cwt.)	1 14/	—	1 14/	—
NICKEL (per lb.)	0 3/6	—	0 3/6	—
BRASS (per lb.)—				
Sheets, 48 × 24.	0 0/8	—	0 0/8	—
Tubes	0 0/11	0 1/	0 0/11	0 1/
Wire	0 0/8½	—	0 0/8½	—
Yellow metal	0 0/6½	—	0 0/6½	—
ASBESTOS (per lb.)	0 0/3	0 0/6¾	0 0/3	0 0/6¾
PLUMBAGO (per ton)—				
Ceylon lump	0 17/6	—	0 17/5	—
Do. chip	0 10/6	—	0 10/6	—
Do. dust	8 6/	—	8 6/	—
COALS (per ton)—				
East Hartlepool	1 2/	—	1 2/	—
Lambton	1 4/	—	1 4/	—
Tees	1 4/	—	1 4/	—
Hartley	1 2/	—	1 2/	—
Hetton	1 4/	—	1 4/	—
Hawthorn	1 3/	—	1 3/	—
Tunstall	1 2/	—	1 2/	—

IRON.

	April 8.		April 15.	
IRON, per ton (at works)*—	£ s.	£ s.	£ s.	£ s.
Bars, Welsh, common	7 5/	7 10/	7 5/	7 10/
Do. Best	8 10/	8 15/	8 10/	8 15/
Scotch, Common	9 0/	—	9 0/	—
Do. Best	9 10/	—	9 10/	—
South Stafford, common	7 10/	—	7 10/	8 0/
Do. Best	8 0/	—	8 0/	9 0/
Sheets, singles, Cleveland	9 15/	10 0/	9 15/	10 0/
Staffordshire	10 0/	11 0/	10 0/	11 0/
Do. doubles, Staffordshire	11 10/	12 10/	11 10/	12 10/
Do. Lattens, Staffordshire	13 0/	14 0/	13 0/	14 0/
Plates, Ship, Stafford.	9 10/	—	10 0/	10 10/
Do. Scotch	—	—	—	—
Do. Boiler, Stafford.	10 10/	—	10 10/	11 10/
Hoops, Stafford	9 0/	9 10/	9 0/	9 10/
Nail Rods, Stafford	8 10/	9 0/	8 15/	9 0/
Swedish in Lond.	11 10/	—	11 11/	12 0/
Angle Iron, Welsh	—	—	—	—
Do. Stafford	8 15/	9 10/	8 15/	9 10/
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 5/	6 10/	6 10/	—
Do. Scotch	—	—	—	—
Rails, Welsh	8 0/	8 10/	8 0/	8 10/
Do. Stafford	8 10/	9 10/	8 10/	9 10/
North England	5 5/	—	—	—
Light Rails, Welsh	8 5/	8 15/	8 5/	8 15/
Do. Stafford	8 15/	9 15/	8 13/	9 15/

	April 8. £ s.	£ s.	April 15. £ s.	£ s.
Pig Iron at Glasgow				
Scotch warrants..	2 16/6	—	2 16/6	—
Do. No. 1	2 19/	3 5/	2 19/	3 5/
Cleveland, Tyne or Tees ...	2 18/	3 0/	2 18/	3 0/
Indian Charcoal, London ...	—	—	—	—
Wrought Iron Girders	18 0/	24 0/	18 0/	24 0/
Bolts and Nuts	18 0/	21 0/	18 0/	21 0/
Fish Bolts	18 0/	23 0/	18 0/	23 0/
Washers	18 10/	19 0/	18 10/	19 0/
Rivets	15 0/	18 0/	15 0/	18 0/
Spikes	17 10/	19 10/	17 10/	19 10/
Swedish Iron—				
f.o.b. Gottenburg, nett cash.				
Pig	—	—	—	—
Bar, rolled	11 10/	12 0/	11 10/	12 0/
Do. hammered	12 0/	12 10/	12 0/	12 10/
Billets	12 0/	—	12 0/	—
Horse Nail Rods	—	—	—	—
Belgian Iron—				
f.o.b. Antwerp, less 2½ per cent.	8 0/	—	8 0/	—
Bars and Slit Rods, common				
Best				
Best Best				
Hammered				
Puddled Steel	Nominal.			
Bessemer				
Hoops				
Rails				
Rolled Girders				
Steel—				
Best cast	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear	45 0/	—	45 0/	—
Do. single do.	38 0/	40 0/	38 0/	40 0/
English spring med. quality...	14 0/	18 0/	14 0/	18 0/
Blister	21 0/	34 0/	21 0/	34 0/
Swedish keg	16 0/	—	16 0/	—
Milan	18 0/	19 0/	18 0/	19 0/
Bessemer rails	10 5/	10 10/	10 5/	10 10/
Scrap (per ton)—				
Old rails for remanufacture, D.H.	6 10/	—	6 10/	—
Ditto flange or bridge	4 10/	6 0/	4 10/	6 0/
Engineers' scrap	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal	2 0/	3 0/	2 0/	3 0/
Old steel scrap...	3 15/	4 10/	3 15/	4 10/
Wire—				
Best best drawn killed gal. tel., Nos. 0 to 6	18 10/	—	18 10/	—
Do. 7 & 8	19 10/	—	19 10/	—
Do. 9	20 5/	—	20 5/	—
Do. 10	21 0/	—	21 0/	—
Do. 11	21 10/	—	21 10/	—
Do. 12	22 10/	—	22 10/	—
Rolled black fencing wire (per ton) 1 to 4	10 10/	—	11 10/	—
Do. 5	12 0/	—	12 0/	—
Do. 6	12 10/	—	12 10/	—
Do. 7	13 0/	—	13 0/	—
Bright Iron Wire (Charcoal wire, 4s. 6d. per bundle extra) per bundle of 63 lb. 0 to 6	0 14/6	—	0 14/6	—
Do. 7 to 8	0 15/	0 15/3	0 15/	0 15/3
Galvanised, 80s. per ton extra.				
Best best annealed drawn fencing wire, per ton 0 to 6	13 15/	—	13 15/	—
Do. 7	13 15/	—	13 15/	—
Do. 8	14 0/	—	14 0/	—
Castings (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 1½ to 2in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 " 4	6 2/6	6 5/	6 2/6	6 5/
Do. 5 " 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 " 16	6 0/	6 2/6	6 0/	6 2/6
Do. 18 " 24	5 17/6	6 0/	5 17/6	6 0/
Bolts and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	19 10/	21 10/	19 10/	21 10/

* The entire ton consists of ten times 100 kilogrammes, or about 30 lb. short of an English ton.

OILS, CHEMICALS, &c.

	April 8. £ s.	£ s.	April 15. £ s.	£ s.
Oils (per ton)—				
Olive, Malaga	—	—	—	—
Do. Gioja	45 0/	—	44 10/	—
Do. Levant	40 10/	—	42 0/	43 0/
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	45 0/	46 0/	44 10/	45 0/
Do. Sicily	45 0/	46 0/	45 0/	46 0/
Seal, pale	30 0/	30 10/	30 0/	30 10/
Seal, yellow	27 0/	—	27 0/	—
Seal, brown	25 0/	—	25 0/	—
Sperm head	73 0/	75 0/	75 0/	—
Cod	26 0/	26 10/	26 0/	26 10/
Whale, pale	26 10/	—	26 10/	—
Do. yellow	25 10/	—	25 10/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	30 15/	—	29 10/	—
Do. brown	27 10/	—	27 10/	—
Foreign Pale	—	—	—	—
Ground nut and Gingelly Madr.	30 10/	31 0/	30 10/	31 0/
Palm oil, fine	31 0/	—	31 0/	31 10/
Palm nut oil	34 0/	—	33 10/	—
Linseed oil	27 5/	—	27 5/	—
Cotton seed oil	26 15/	27 5/	26 15/	27 5/
Lard	42 0/	44 0/	42 0/	44 0/
Cocoanut, Cochin	36 0/	38 10/	36 0/	37 10/
Do. Ceylon	33 0/	33 10	33 0/	—
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent engine oil (per gal.)	0 3/6	—	0 3/6	—
Oil Cake (per ton)—				
Linseed, Ludn.	11 0/	—	11 0/	—
American bls.	10 5/	—	10 10/	10 12/6
Do. bags	10 12/6	—	9 2/6	9 5/
Marseilles	9 5/	—	9 5/	—
Rape, English	5 0/	—	5 0/	—
Do. Foreign	—	—	—	—
Green Cotton	5 17/6	7 0/	5 17/6	7 0/
Tallow—PYC.	43 0/	—	43 0/	—
S.Americn. Beef	41 0/	—	41 0/	—
Do. Sheep	36 0/	—	36 0/	—
Australian Beef	30 0/	34 0/	30 0/	33 0/
Do. Sheep	35 0/	—	34 10/	—
Rough Town Fat.	14 0/	—	14 0/	—
Petroleum—				
Fine (per gal.)	0 0/5¾	0 0/6¼	0 0/5¾	0 0/6¼
Do. spirit	0 0/7	0 0/7¼	0 0/7¼	—
Turpentine—Spirit—				
French	—	—	—	—
American (casks)	1 15/	—	1 15/	—
Whalefins (per. ton)—				
Davis' Straits	1100 0/	—	1000 0/	—
Arctic	1000 0/	—	950 0/	1 02 0/
Southern	500 0/	—	500 0/	—
Brimstone (per ton)—				
Rough, 2ds Ind.	7 0/	—	7 0/	—
Do. 3rds, do	5 10/	—	5 10/	—
Roll	8 15/	—	9 10/	10 5/
Sulphur, Flour (per cwt.)	0 12/9	0 12/6	0 10/9	0 12/6
Acid, (per lb.)				
Acetic, fine	0 0/4	—	0 0/3	0 0/3 3-14
Do. common (per gal.)	0 1/5	0 1/6	0 1/5	0 1/6
Citric	0 2/9	—	0 2/9	—
Muriatic fine (per cwt.)	0 6/	0 7/	0 4/	0 7/
Do. common	0 4/	0 5/	0 4/	0 5/
Nitric	0 0/4½	—	0 0/4½	—
Oxalic (per lb.)	0 0/4½	—	0 0/5	—
Sulphuric, concentrated	0 0/0¾	0 0/1	0 0/1	—
Do. Brown	0 0/0¾	0 0/1	0 0/0¾	0 0/1
Tartaric Crystal	0 1/9	—	0 1/9	—
Do. Pulv.	0 1/9	—	0 1/9	—
Ammonia—				
Carbonate, per lb.	0 0/6½	0 0/6¾	0 0/6½	0 0/6¾
Sulphate, White & grey (per ton)	19 0/	19 5/	19 0/	—
Arsenic—White Lump (per ton)	24 0/	—	23 10/	—
Powdered, do.	11 0/	—	11 0/	—
Bleaching powder	0 8/6	—	0 8/6	—
Borax, Rfd., do.	3 2/	—	3 5/	—
Copperas (ton)	2 10/	—	2 15/	3 5/
Bi-Sulphide Carbon (per ton)	24 10/	26 0/	24 10/	26 0/
Portland Cement—				
1st quality, in cks 400 lb. gross, inc. csks., f.o.b., Thames, per csk.	0 9/	—	0 9/	—
Do. in sks, 200 lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/6 each.				
Charlton White Paint (per cwt.)	1 12/	—	1 12/	—
Calley's Torbay Paint, Brown	0 30/	—	0 30/	—
Do. Red	0 34/	—	0 34/	—
Hypophosphites (per lb.)—				
Iron	0 9/3	0 10/	0 9/3	0 10/
Lime	0 5/3	0 7/	0 5/3	0 7/
Magnesia	0 9/	0 9/	0 9/	0 9/
Manganese	0 9/	0 9/	0 9/	0 9/
Soda	0 5/3	0 6/	0 5/3	0 6/
Lead (per cwt.)—				
Acetate,...best	2 0/	—	2 0/	—
Nitrate	1 15/	—	1 15/	—
Red (per cwt.)	0 18/	—	0 18/	—
White	1 4/	—	1 4/	—
Litharge (pr cwt.)	1 1/	—	1 1/	—
Lime (per ton)—				
Acetate, Grey, 85 %	19 0/	—	19 0/	—
Do. Brown 70%	14 0/	—	14 0/	—
Potash—				
Bichromate (lb.)	0 0/6¾	—	0 0/6¾	0 0/7
Chlorate (pr. lb.)	0 0/7½	—	0 0/7½	—
Muriate, 80% ton	6 15/	—	6 15/	—
Pruss. Red (lb.)	0 1/11	—	0 1/8	0 1/10½
Do. Yel. lb.	0 0/11¼	0 1/	0 0/11¼	0 1/
Sulphate, 80% (per ton)	14 0/	16 0/	9 0/	10 0/
Saltpetre (per cwt.)—				
Engl. refnd. kgs.	1 8/3	—	1 8/3	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 19/6	1 1/6	0 19/6	1 1/6
Soda—				
Ash ... deg.	0 0/1 15-16	0 2/	0 0/1 15-16	0 2/
Bicarb. (per cwt.)	0 11/6	—	0 12/	—
Caustic, 60 % to 72%	0 11/6	14 0/	0 12/	0 12/6
Nitrate (per ton)	18 3/	—	17 10/	—
Crystals (per ton)	3 15/	—	3 15/	—

* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

Attacks of Torpedo Boats.—The Admiralty have at last settled the much-vexed question as to which system of machine or mitrailleuse is best adapted for use in the Royal Navy for repelling the attacks of torpedo boats, by adopting the Nordenfeldt 4-barrelled gun, which fires twelve solid steel shots per second. The selection of this gun in preference to the Hotchkiss revolving cannon or Gatling gun has only been made after a series of most exhaustive experiments had been carried out to prove that the improvements recently made by Mr. Nordenfeldt with his gun had rendered it a perfectly safe weapon, and far superior to all others offered to the Government.

IRON EXPORTS.

Comparative exports of pig, merchant, and railway iron for the last twelve months.

Port.	1879. April.	1879. May.	1879. June.	1879. July.	1879. Aug.	1879. Sept.	1879. Oct.	1879. Nov.	1879. Dec.	1880. Jan.	1880. Feb.	1880. March.
(Pig Iron.)	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Ardrossan	500	1,885	196	965	2,280	1,850	5,510	2,600	555	—	4,281	10,666
Borrowstoness	180	335	200	102	—	—	—	—	—	—	—	—
Cardiff ...	278	750	10	7	208	60	1,103	500	700	950	110	18
Charlestown	—	30	—	15	—	—	—	—	—	—	—	—
Glasgow	10,153	8,237	5,504	6,912	8,432	16,786	21,129	16,186	12,314	13,895	10,755	24,123
Goole ...	—	100	—	—	—	—	156	94	—	—	—	—
Grangemouth	11,083	10,955	1,524	2,460	2,110	2,870	3,447	1,285	320	960	1,084	3,295
Granton...	30	—	10	30	—	9	—	10	20	—	—	110
Greenock	108	10	—	175	180	2,490	6,009	—	60	200	—	370
Grimsby...	130	72	16	20	35	50	5	—	—	250	—	400
Hartlepools	2,280	2,414	1,540	1,109	2,223	2,111	4,149	2,765	1,696	1,229	1,869	4,990
Hull	1,207	1,711	2,601	1,069	1,618	1,478	2,871	2,191	3,205	2,118	3,797	1,312
Liverpool	2,402	1,751	1,861	2,534	2,851	10,892	21,131	17,637	11,391	54,461	19,748	21,863
Middlesborough	38,911	44,167	25,449	29,652	31,288	49,691	48,528	31,723	1,086	32,380	38,532	56,119
Newcastle-on-Tyne	1,925	5,991	2,184	4,169	4,498	5,114	7,392	7,523	3,350	9,480	3,660	5,101
Newport	41	45	—	110	—	—	50	1,000	—	1,550	381	2,737
North Shields	—	—	—	400	322	—	250	66	—	—	—	—
Port Glasgow	—	—	—	—	—	200	—	—	—	—	—	—
South Shields	—	85	—	—	—	70	140	510	—	6	—	—
Sunderland	310	540	180	50	—	—	—	—	—	655	970	—
Swansea	—	4	—	20	—	—	—	—	20	—	252	1,250
Troon ...	780	550	310	2,250	400	20	—	3,850	200	1,620	40	9,200
Whitehaven	46,521	5,145	850	4,320	1,290	3,800	700	2,100	1,200	1,100	1,050	2,748
(Merchant Iron.)												
Ardrossan	—	—	6	—	—	—	—	—	—	—	—	—
Cardiff ...	2,616	2,445	—	823	3,560	936	1,299	2,016	2,708	263	982	1,533
Glasgow	1,524	997	592	723	934	619	883	776	716	1,435	14	573
Goole ...	11	—	—	—	—	—	—	—	—	—	—	—
Grangemouth	25	—	—	—	—	—	—	—	—	—	—	—
Greenock	—	—	—	—	—	14	—	—	—	—	—	—
Grimsby	26	10	33	15	5	8	4	5	50	—	—	18
Hartlepools	464	734	765	995	42	564	632	89	517	210	94	33
Hull ...	461	984	804	913	1,247	1,505	2,676	3,505	1,239	1,985	1,157	983
Llanelly	—	—	—	—	—	450	—	—	—	—	—	—
Liverpool	7,425	6,282	6,795	6,377	5,250	7,611	10,170	12,640	11,114	12,111	12,046	18,915
Middlesborough	3,073	5,154	4,022	3,486	775	1,095	943	1,913	517	37	56	39
Newcastle-on-Tyne	1,220	4,102	1,220	1,336	1,250	1,685	1,510	1,377	3,075	331	379	678
Newport	—	—	—	32	—	—	—	321	20	—	—	—
North Shields	—	439	124	13	—	—	10	—	—	—	—	—
Seaham...	—	—	—	—	—	—	—	—	—	—	—	—
South Shields	21	90	1	47	29	58	187	189	5	80	—	—
Stockton	199	—	—	—	—	—	—	—	—	—	—	—
Sunderland	25	—	11	6	—	—	545	—	—	—	20	—
Swansea	—	—	—	385	936	922	39	1,016	52	240	83	—
(Rails.)												
Ardrossan	—	—	—	—	—	—	—	1,000	940	—	—	215
Cardiff ...	7,120	3,427	4,532	5,351	10,174	11,380	10,192	6,007	7,043	12,005	9,503	17,139
Glasgow	—	—	—	503	900	1,536	—	3,504	704	640	82	—
Greenock	—	—	—	—	700	—	—	—	—	—	—	—
Grimsby	—	—	—	—	—	410	687	1,005	410	1,000	—	2,298
Hartlepools	—	50	—	—	—	—	—	—	450	—	—	50
Hull ...	484	37	1,285	7	9	157	827	1,315	—	1,594	354	978
Liverpool	2,018	5,621	8,420	8,642	7,440	8,492	9,116	12,580	8,950	11,732	6,654	13,607
Middlesborough	2,314	2,950	4,358	2,105	1,065	1,684	2,031	1,733	450	2,600	500	5,104
Newcastle-on-Tyne	—	3	4	1,171	42	—	3	—	255	—	—	20
Newport	3,433	5,501	4,691	10,686	5,013	8,758	3,222	4,206	5,803	7,237	6,895	8,893
Port Glasgow	—	—	—	—	—	—	—	503	—	—	—	—
South Shields	—	10	—	—	—	—	—	100	—	—	—	—
Sunderland	—	—	—	—	—	—	—	—	1,070	—	—	—
Swansea	—	10	—	—	1344	—	733	346	688	608	—	553
Troon ...	—	—	—	—	—	480	6,000	—	—	—	—	—

COAL AND COKE EXPORTS

To foreign parts from the principal English ports in the months of March, 1879 and 1880, and for the whole year 1879.

Port.	Coal. Mar., 1879.	Coke. Mar., 1879.	Coal. Mar., 1880.	Coke. Mar., 1880.	Coal. 12 months 1879.
	Tons.	Tons.	Tons.	Tons.	Tons.
Alloa	12,052	—	10,902	—	150,999
Amble ...	3,482	—	6,407	—	76,504
Ardrossan	3,830	—	2,331	—	62,970
Ayr	478	—	508	—	7,944
Blyth	11,839	—	20,236	—	190,557
Borrowstoness	736	—	697	—	32,840
Cardiff ...	361,908	808	400,706	550	4,253,678
Charlestown	5,961	—	17,151	—	184,534
Dundee	8,598	—	3,913	—	66,125
Glasgow	26,157	720	14,997	235	244,780
Goole	20,770	—	31,766	—	255,640
Grangemouth	4,697	—	7,131	10	118,768
Granton	4,812	—	4,783	—	120,436
Greenock	8,472	—	8,475	—	119,731
Grimsby	9,885	—	13,359	—	257,016
Hartlepools...	41,948	445	45,836	3,435	517,958
Hull	16,762	—	43,500	251	419,368
Irvine	—	—	891	—	4,787
Liverpool	66,466	1,056	30,612	786	552,181
Llanelly	8,686	—	10,123	—	71,127
Middlesboro'	1,688	860	4,320	1,280	28,515
Newcastle	223,973	9,054	354,059	16,952	3,751,794
Newport	81,315	—	84,332	62	938,012
North Shields	17,520	55	20,379	—	220,348
Port Glasgow	—	1,290	—	—	10,649
St. David's	3,647	—	7,985	—	54,907
Seaham	2,210	—	3,296	—	35,374
South Shields	30,371	242	33,013	—	358,711
Sunderland	91,107	1,588	95,436	380	1,015,928
Swansea	62,297	1,180	70,635	1,024	670,419
Troon	10,470	—	6,105	—	104,189
Whitehaven	—	—	—	—	309

Shipped for English ports from the undermentioned, in the months of March, 1879 and 1880 and for the whole year 1879.

Port.	Coal. Mar., 1879.	Coke. Mar., 1879.	Coal. Mar., 1880.	Coke. Mar., 1880.	Coal. 12 months 1879.
	Tons.	Tons.	Tons.	Tons.	Tons.
Alloa	354	—	918	—	15,302
Amble ...	5,850	—	8,359	—	91,300
Ardrossan	15,417	—	13,481	—	221,554
Ayr	22,284	—	26,020	—	354,570
Blyth	1,745	—	2,120	—	43,597
Borrowstoness	1,865	—	1,637	—	30,542
Cardiff ...	73,366	38	68,511	—	826,044
Charlestown	385	—	1,135	—	11,370
Dundee	575	—	245	—	2,091
Goole	5,654	—	3,816	—	87,008
Granton	3,415	—	3,381	—	65,972
Grimsby	1,242	—	1,286	—	38,392
Hartlepools	51,308	—	43,606	—	607,393
Hull	710	—	1,389	—	51,260
Irvine	6,207	—	9,549	—	102,189
Liverpool	32,041	—	28,264	—	478,059
Llanelly	9,749	—	11,293	—	126,383
Middlesboro'	4,201	227	1,507	—	46,053
Newcastle	220,596	680	213,446	251	2,586,640
Newport	86,022	—	67,319	—	983,558
North Shields	—	—	—	—	719
St. David's	—	—	—	—	872
Seaham	36,968	—	41,049	—	558,899
South Shields	17,805	—	24,740	—	238,720
Stockton	—	—	245	—	1,222
Sunderland	183,375	—	168,405	—	2,091,559
Swansea	51,605	—	52,742	44	543,207
Troon	17,335	—	17,741	—	201,448
Whitehaven	12,687	—	13,123	—	217,545

WILLIAM SUGG'S
IMPROVED SYSTEM OF STREET LIGHTING,

EXTRACT FROM THE JOURNAL OF GAS LIGHTING, &c., MARCH 16TH, 1880.

Experiments in Improved Street Lighting at Birmingham.

PUBLIC TRIAL, WEDNESDAY, MARCH 10, 1880.

After a prolonged inspection of the various lanterns and burners, tests were made by a shadow meter between Sugg's 200-candle Argand (No. 9), Bray's 200-candle Quadruple Batswing (No. 10), and the Burner and Lantern as used by the Paris Gas Company in the Rue du Quatre Septembre (No. 12), with the results as shown in diagram, Fig. 2. These appear to agree pretty nearly with the photometrical results obtained from each burner, as shown in the preceding table (Mr. Hunt's Experiments, see page 404 of *Journal of Gas Lighting*, March, 1880).

PHOTOMETRICAL TRIALS.

No. 9.
Sugg's 200-Candle
Argand Opal Top,
Consumption per hour
44 *cub. ft.*

No. 10.
Bray's 200-Candle.
Quadruple Batswing.
Consumption per hour
50 *cub. ft.*

No. 12.
Burner and Lantern used by the
Paris Gas Company in the Rue
du Quatre Septembre, Consumption per hour, 32 *cub. ft.*

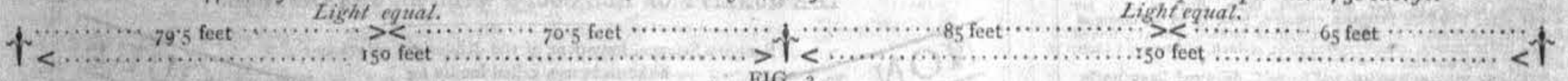

FIG. 2.

NOTE.—The Lights were fixed on Posts in the manner they are used in the Public Streets.

THE RESULTS WORK OUT AS FOLLOWS:—

No. 9.
27 per cent. better than No. 10.
= 191·7 Candles.
Add 24 Candles for the extra 6 ft. of gas required to equal the consumption of No. 10.

No. 10.
= 151 Candles.
or 8 per Cent.
better than No. 12.

No. 12
= 92·8 Candles.
If the consumption had been 50 ft. the Illuminating power would have been at the same rate—138 Candles.

Total 215·7 Candles or 42 per cent. better than No. 10 for the same quantity of Gas.

The next best on the List is Sugg's 100-candle Argand Burner, as fixed on the Refuges, in the districts of the Phœnix Gas Company, London Gas Company, Commercial Gas and Gas Light and Coke Company. They have been, moreover, definitely adopted by the Vestries of Lambeth, St. George's, St. Mary's, Rotherhithe, Lewisham Board of Works, St. Giles Board of Works, as well as the Great Eastern, Great Northern, London, Brighton and South-Coast and Metropolitan Railways.

The fact that over 1200 of these large Burners and Lanterns have been supplied to almost every Gas Company or Municipal Authorities in England alone, within a very short time, speaks significantly of the excellence of this system and the real merits it has been proved to possess.

Amongst other places the Burners and Lanterns have been adopted, are the following cities:—

PETERBOROUGH
LEEDS
SCARBOROUGH
EASTBOURNE
DURHAM
CHESTERFIELD
CORK
NOTTINGHAM
LEICESTER
STOKE-UPON-TRENT.
RAMSGATE
BLACKBURN
GREENOCK
LIVERPOOL
DONCASTER
LONDONDERRY
SHEFFIELD
BELFAST
OLDHAM
GLASGOW
DUBLIN
HASTINGS
SUNDERLAND
ROCHDALE
SOUTH SHIELDS
IPSWICH
BRIGHTON
COLCHESTER
GREAT GRIMSBY
SWANSEA
CARDIFF
WEST HARTLEPOOL
SOUTHAMPTON
PORTSMOUTH
LEITH
PAISLEY
PERTH
WIGAN
READING
SALFORD
MANCHESTER
BIRMINGHAM

Buenos Ayres, Monte Video, Hong Kong, Singapore, New York, Philadelphia, San Francisco, Milwaukee, Quebec, Ontario, Ottawa, Boston, Sydney, Melbourne, Port Adelaide, Berlin, Vienna, Cologne, The Hague, Amsterdam, Rotterdam, Brussels, &c., &c.

SCOTCH PIG-IRON.

ANNEXED is a weekly statement of the shipments during this and the previous three years:—

Week end.	1880 Tons	1879 Tons	1878 Tons	1877 Tons
Jan. 3 ..	6677	4655	2441	3454
10 ..	6689	6069	6085	6500
17 ..	12,288	6291	4532	5141
24 ..	7566	6331	6170	7040
31 ..	13,383	4969	6550	5297
Feb. 7 ..	14,190	6130	5637	6183
14 ..	10,612	7272	5722	5839
21 ..	15,152	8996	5124	6559
28 ..	12,603	8318	7836	8630
March 6 ..	17,968	13,910	6816	8048
" 13 ..	20,985	10,743	8662	7280
" 20 ..	20,987	11,167	7725	9312
" 27 ..	23,598	9,463	11,499	10,246
April 3 ..	15,722	12,653	7448	9071
" 10 ..	18,309	12,913	9441	10,721
Total ..	219,829	129,880	101,688	107,611

PRICES CURRENT OF MANUFACTURED GOODS OF BIRMINGHAM AND DISTRICT.

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The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material.

The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

APRIL 15TH, 1880.

Last week we had little to report in actual changes except in gas-tubes, which are now quoted 5 per cent. more discount than they were a month ago. At present the fall in the iron market has not had the effect of bringing other heavy goods down yet, and makers are looking forward to a stiffening in prices ere long. This week we have both increases and decreases in prices of hardware proper. In reductions we first have sofa springs, which have lately come down to the extent of quite 10 per cent., owing entirely to the drop in iron ware, although the lists of wire of the principal makers still show no alteration. The Bromsgrove nail makers are offering 2½ more discount all round, but as there are scarcely two makers with the same list we cannot quote discounts that will guide; the list quoted in our price current being 22½ per cent. Washers are reduced 6 per cent. on heavy, the discount on light being now quoted at 2½ per cent., which is an increase of 2½ per cent. The discount off plate locks is increased 2½ per cent., equal to net increase of over 5 per cent. on common, and a little less on best fine. Present discounts are now:—Fine plate-locks, 50 per cent. to 52½ per cent.; best fine or strong, 40 per cent. to 42½ per cent.; brass rim and mortise lock furniture, brass shutter knobs, ash-pan knobs, cupboard turns and ranger knobs are advanced in discount 22½ per cent. equal to a net reduction of about 7½ per cent.; common brass lock furniture is now quoted at from 55 per cent. to 60 per cent., and the same off the knobs mentioned. In the shipping tackle line, one Black-country maker has just advanced his prices 5 per cent. Trade in hardware branches is reported as improved by the receipt of foreign indents.

ABRIDGED LIST.

Axles, 15 to 25%; coach ironwork, 10 to 15%; coach and waggon springs, 15 to 20%; Augers, 10 to 20%. **Axes.**—Ship carpenters', /5½ to /6 per lb.; Kent and house carpenters', /5 to /6; ditto, steel polished, /5½ to /7; felling axes, /4¼ to /4¾; polished, /4½ to /6; bright and blued solid steel, /7 to /8; American felling or wedge Axes, steel polished, 1/ to 1/4 per lb.; common **Anvils**, 84 lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27/ to 35/.

Basins, shallow galvanised, 10 inch, 7/ to 7/6 per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard **Bellows**, 42½ to 50%; Best extra nailed Bastard, 37½ to 45%; Best improved long Bristol, 35 to 40%; casters' or moulders', best extra nailed, 12 inch, 30/ per doz. net; common **Smiths' Bellows**, 45 to 50%; Best warranted, extra leather double nailed, 36 to 40%; with movable pipe for shipment 2½% less discount. **Bed screws**, 6 and 7-16 and ⅜ inch, 10/6 to 11/6 per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and ⅜ inch nuts, 12/9 to 13/9; Black welded heads, 9/3 to 10/3; common slit heads, 6 and ⅜ and ¼ inch, 9/3 to 10/3; Bright turned notched heads, 6 and 7-16 and ⅜ inch, 12/9 to 13/9; black notched heads, 10/6 to 11/6 per gross; **Brass head nails**, 40 to 42½%; star head, 35 to 40%; Brass plated countersunk head, 25 to 30%; **Blacksmiths' tongs**, 26/ to 28/ per cwt.; real fine wrought **Box irons**, 20 to 25%; fine cast, 42½ to 60%; middle cast, 42½ to 60%; charcoal box irons—Victoria, 45 to 50%; ordinary charcoal box irons, 55 to 70%; **Bolts**—Straight tower; solid end tower, 65 to 67½%; end Best solid tower, 60 to 65½%; solid end barrel brass knob, 60 to 62½%; japanned Scotch tower bolts, 45 to 50%; painters' brushes, 45 to 65%; Best, 10 to 46%; light galvanised **Buckets**, 12 inch, 38 lb. to the doz., 10/ per doz. net; **Blind cord**, list price net; **Bed hooks and eyes**, 50 to 55% malleable, 62½ to 67½%; Brass chain **Beading**, 30 to 35%; Brass and plate coach beading, 30 to 35%; ashpan moulding, 20 to 30%; **Bottle jacks**—Linwood's, 15 to 20%; Salter's, 30 to 35%; Nicholas's, 15 to 20%; common painted **Beams**, 35% to 65%; Bright round end beams, 40% to 55%; Bright box end beams, 40 to 55%; deep **Copper scales**, 45 to 65%; **Steelyards**, 40 to 60%; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30%; common, with round copper scale, 7 lb., 3/ to 5/; 14 lb., 3/9 to 5/9; 28 lb., 5/ to 8/ each, net; **Bedsteads**, cheap stump, 6 feet by 3 feet 6 in., 7/6 to 9/6 each; cheap French, 6 feet by 3 feet 6 inches, 8/6 to 10/6 each, rising /6 for every 6 inches. **Brass**—Rolled brass, 2 to 12 inches wide, to 30 W.G., /9½ to /10 per lb.; Brass sheets, 24 by 48 in., 8 lb. and upwards or 27 W.G., /9¼ to /10¼ per lb.; **House bells**, brass rough, /10 to 1/1 per lb.; turned edge, /11½ to 1/1; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3½ to 1/6 per lb.; clock bells, 1/9 to 1/10; ship and turret bells best, 1/4 to 1/5 **Battery kettles**, 150/ per cwt.; composition sheathing and **Slating nails**, /10½ to /11 per lb.; Brass **Escutcheon pins**, ⅝ by 16 inch, W.G., /10½ to /11. **Brass jelly pans**, with bails, 11/ to 1/; without bails, 1/ to 1/1 per lb. **Maslin kettles**, cast, 4 to 16 inch, /10½ to 1/ per lb. **Pinpoints**, 1/3 to 1/4. Brass **Rivets** for boots, 12 to 17, W.G., /10 to /11 per lb. Brass **Shoe Bills**, 1/1½ to 1/2½ per lb. Brass **Scale pans**, 1/11 to 2/; Brass **Toddy kettles**, 15 to 20%. Brass **Tubes**, plain rough, ⅜ inch and above, /10¼ to /11 per lb. Locomotive and marine boiler tubes, seam less from 1⅜ to 4 inch outside diameter, to 14, W.G., /8½ to /9½.

Copper.—**Copper boat nails**, wrought 1½ by 12 inch, W.G., and upwards, /10½ to 1/1 per lb. Copper 1 boat **Roves**, ½ inch and upwards 1/2½ to 1/3 per lb. Copper **Brads and bills**, same price as tacks. Light round Copper **Kettles**, bare rivets, 1/11½ to 2/ per lb. Light round covered rivets, 1/10 to 1/11½; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/3 to 2/4 per lb.; oval bare rivets raisedown, 2/5 to 2/6 per lb. Copper **Rivets** and washers, 1/ to 1/1 per lb.; Copper **Slating nails**, cut, 1 to 1½ inch and upwards, /11½ to 1/ per lb.; Copper **Scale pans**, 1/11 to 2/2 per lb.; cut Copper **Nails and tacks**, 1 inch and upwards, 1/ to 1/1 per lb.; wrought Copper nails and tack, 1/4 to 1/5 per lb.; Copper **Wire**, 0 to 20 W.G., /10¾ to /11. **Brass cupboard turns**, 45 to 52½%; **Chair webbing**, No. 9, 4/5; 10, 4/8; C9, 4/1; C10, 4/6 per gross of 66 yards; **Carpet rings** 1/ to 1/6 per gross; **Cornice poles**, 2⅜ inch, brass best burnished 4/6 per foot, 25 to 35%, 3/4 covered; brass poles, 1/2 per foot, 25 to 35, imitation mahogany cornice poles with ends and rings complete, 2⅜ inch, 1/ per foot; light birch ditto, 1/1 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2⅜ inch, light, 2/9; middle, 3/7; strong, 4/2 per doz., 20 to 30%; wood cornice pole rings, 2⅜ inch, imitation mahogany, 16/ to 18/ per gross net; light birch, 17/ to 19/; real mahogany, 22/ to 25/ per gross net; machine made wire **Chain**, single link, iron, 42½ to 47½%; double link, iron, 37½ to 47½%; single link, brass, 37½ to 47½%; registered double link, brass, 32½ to 37½%; close link brass Chain, 5 to 10% brass oval lamp Chain, 22½ to 27½%; brass Clock Chain, 22½ to 27½%; japanned pillar Chains, 1 yard, 10 by 6, 6/8 to 7/6 per doz.; japanned manger, 1½ yard 16 by 6, 8/3 to 9/6; japanned rack, 1 yard, 18 by 6, 5/6 to 6/6, japanned dog, 1½ yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 11/ to 12/. **Cowties**, a chain, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/; close ring, 7/ to 8/ per doz.; japanned watering chains, 14 by 6, 4/9 to 5/9; tinned watering chains, 5/ to 6/; bullock chains, ⅝ inch hook at each end, 19/ to 20/ backbands, 19/6 to 20/6; short link Chain, plain or twisted, ⅜ inch, 18/ to 20/; ½ inch, 16/ to 18/; 1 inch, 14 to 16/ per cwt.; Cart and plough traces, 21/ to 23/ per cwt. **Chesthandles**, improved japanned, 75 to 77½%; broad plate, strong and extra strong, 15 to 55%, according to strength; railway **Cotterpins**, 55 to 60%; Brass **Curtain rings**, 37½ to 42½%; Brass **Chair nails**, 40 to 45%; square box **Coffee mills**, 25 to 50%; Common post Coffee mills, 20 to 30%; best brass bushed mills, 40 to 45%; London mills, 35 to 40%; registered **Coffin furniture**, 45%; Common, 70%.

Door springs, **X**, 75 to 80%; **XX**, 70 to 72½%; **XXX**, 65 to 67½%; **XXXX**, 55 to 60%; brass circular and iron circular, 55 to 60%; brass reliance, 10 to 15%; climax, 5 to 10%; universal, 50 to 60%; paragon, 10 to 15%; smiths', 10 to 15%; O'Connor's patent lever hinge springs, 10 to 15%; O'Connor's vertical spring hinge door spring, 15 to 25%; Gerish's spring hinges, iron, 20 to 25%; brass, 10 to 15%; japanned **Door chains**, 30 to 60%.

Files, 25 to 50%; **Frying pans**, best, 47½ to 52½% common, 55 to 62½%; kitchen **Fireirons**, in sets, /6 to /7 per lb.; tongs only, /6½ to /7; pokers only, /5¾ to /6 per lb. **Fish hooks**, 30 to 35%, best; common, 50 to 55%; light kitchen **Fenders**, 5 inch assorted, 2 feet 6 inches to 3 feet 6 inches, black fronts, 28/ to 29/ per doz.; bright fronts, 31/6 to 34/; Manchester pattern kitchen Fenders, 5 feet 1 inch top, black front, 2 feet 9 inches to 3 feet 3 inches, 37/6 to 41/ per doz.; 3 feet 3 inches to 3 feet 9 inches, 42/6 to 46/. Cut wire **Fencing staples**, 0 to 6, 22/ to 24/ per cwt.

Gridirons, London pattern, fluted, 62½ to 65%; light ditto, 61½ to 67½%; hanging round bar, 50% to 55%; doublet, 37½ to 42½%; round bar /1½ per bar, 57½ to 62½%; best fluted bar, 5½ to 62½%; flat bar, 57½ to 62½%; common flat bar, 57½ to 62½%; common Gridirons, /1, /1½ and /2 per bar, 65 to 70%; **Goffering tongs**, two prongs, 5/6 to 6/6 per doz.; **Gimblets**, 10 to 15%.

Holdfasts, japanned, 20/ to 21/ per cwt. **Hammers**, platelayers' keying, 33/ to 35/; miners', 27/6 to 28/6; sledge, 27/6 to 28/6; stone sledge, 27/6 to 28/6; stone, hand, 28/6 to 30/6; stonemasons' hand, 2 to 6 lb., 28/6 to 30/6; pin maul, 2 to 6 lb., 35/ to 37/ per cwt.; sledge hammers, 6 lb. and upwards, 28/6 to 30/6 per cwt.; riveting hand-hammers, 28/6 to 30/6; miners, not steeled, 22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50%; patent hasps and staples, 20 to 25%. **Cast hinges**, polished joint light patent tariff butts, 200, 45 to 50%; 333, 42½ to 47½%; 564, 35 to 40%; polished joint, best best butts, best best, 45 to 50%

ditto light tariff, broad butts, 45 to 50%; best heavy, broad butts, 30 to 35%; **Patent Hinges**, edge butts, light, 60 to 62½%; strong, 40 to 50%; patent Scotch butts, 52½ to 55%; same off broad and narrow. Patent table, bed and back-flap hinges, 50 to 52½%; extra strong bed hinges, 42½ to 55%; patent chest, 45 to 47½%; patent strap, 45 to 55%. H Hinges, 40 to 55%; HL hinges, 40 to 55%; japanned and garnett hinges, double washered, light and strong, 35 to 40%; best best patent London or Lancashire tees, 52½ to 60%; patent light japanned Scotch Tees, 55 to 62½%; light patent hooks and hinges on plate and to drive, 20 to 25%; weighty patent hooks and hinges, weighty Gothic, 21/ to 26/; scolloped edges, not japanned, 22/ to 24/; Scotch japanned, Tees double washered, 20/6 to 23/6; Gothic Scotch japanned, Tees 23/ to 28/; Gothic Scotch, Tees self colour, 17/6 to 25/. **Wrought hinges**, common and best, 35 to 40%; best best, 30 to 35%; heavy wrought hinges, common black, 14/ to 16/ per cwt.; common bright, 16/ to 18/; filed edges, 17/ to 19/; japanned Gothic fancy, 16/ to 20/ per cwt. common bright, broad eye, 19/ to 22/; japanned broad eye fancy, 21 to 22/; best bright, 22/ to 24/; best broad eye, 23/ to 25/; best self-colour frog hooks 25/ to 26/ per cwt.; **Lancashire hinges** wrought, 30 to 35%; **Pressed hinges**, common, 62½ to 65%; best, 52½ to 57½%; common brass butt hinges, 1½ inch sanded, 15/ to 18/ per gross, pairs net; very light, 1½ inch, 9/6 to 12/ per gross, pairs net **horseshoes**, fullered fore, 18/ to 20/; fullered hind, 19/ to 21/; stamped, fore, 18/6 to 20/6; hind, 18/6 to 20/6. **Hollowware**, 40 to 45%; common to best, enamelled, 15 to 20%, delivered in Liverpool, London.

Knitting pins, iron, /4½ to /5 per lb.; steel knitting pins, 15 to 24 W.G., 1/ to 2/6 per lb.; brass knitting pins, 1/4 to 1/6 per lb.; **keys and banks**, 50 to 55%; extra strong plate, 30 to 32½%; extra strong Banbury, pin'd keys, 30 to 35%; brass shutter **knobs**, 55 to 60%; brass cupboard turns, 55 to 60%; brass drawer knobs, 53 to 60%; brass ash pan knobs, 55 to 60%; brass range knobs, 40 to 45%; **kettle ears**, 77½% to 80.

Lock furniture, brass, 60 to 65%; buffalo, 25 to 30%; china lock furniture, 37½ to 42½%; ebony lock furniture, 2¼-inch, Wilkes' spindles, 15/ to 18/ per dozen sets; sham ditto, 8/ to 9/ per dozen sets; **Norfolk latches**, common, best, 55 to 65% common **Suffolk latches**, 70 to 72½%; best Suffolk latches, 45 to 55%; tinned **struck ladle bowls**, 4-inch, 15/6 to 16/6; 4½-inch, 18/6 to 20/; 5-inch, 23/ to 25/ per gross net.

Netting, wire, galvanised, 57½% to 60½%, delivered **Cast nails lath**, 10/6 to 11/6 per cwt.; cast wall nails 9/6 to 12/ per cwt.; cast headed bills, ⅜ by 8 ounce, 15 to 16/; fine round cast bills, ⅝-inch, 14/ to 16/; strong round cast bills, ⅝-inch, 13/ to 16/; cast slate pegs, 13 to 17/; cast garden loops, 15/ to 17/ per cwt., all at works. **Patent wrought nails**, 32½ to 37½% per thousand and 27½% those sold as weighty by the cwt.; **patent machine-made horse nails**, 25 to 30%; **cut nails**, clasp, clout or rose nails, 3 inch and upwards, 11/ to 12/6 per cwt. cut lath nails, 1 inch and upwards, 14/ to 15/6; cut flooring brads, 2½ inch and upwards, 11/3 to 12/9; fine cut tacks, ½ inch, 35/ to 38/ per cwt.; ¾ inch 31/6; 1 inch, 27/6 to 28/6 per cwt.; fine cut joiners' brads, or strong, 1½ inch, 16/ to 18/; 2 inch, 15/ to 17/6; 2½ inch, 15/ to 17/; 3 inch, 14/ to 15/6 per cwt.; cut shoe bills, strong, or 12 W.G., 13/6 to 15/6 per cwt.; middle, or 14 W.G., 13/ to 15/; fine, or 15 W.G., 15/6 to 16/6; fine cut tacks, per packet, 75 to 80%; fine cut brads, per packet, 62½ to 65%; **wrought nails**, long count, 15 to 20%; wrought nails, May, 1826 list, to 32½ 37½%; **wrought Bromsgrove nails**, March, 1878, list, 20 to 22½%; best countersunk clout nails 1, inch, 35/6 to 37/6; 2 inch, 26/ to 27/6; 2½ inch, 22/ to 25/6; best best countersunk and **half-countersunk horse nails**, fine best; Swedish charcoal iron, 17/6 to 19/6% list prices; wrought rose or dock-head **spikes**, 4 inch, 15/6 16/; 5 inch, 15/6 to 16/; 6 inch, 15/ to 16/; fine, /6 to 1/ per cwt. extra; galvanised, 7/ to 8/ per cwt. extra; **wrought rose nails** for India, 2 inch, 10 lb., 21/6 to 22/6; 2½ inch, 13 lb., 20/ to 21/; 3 inch, 20 lb., 19/ to 19/6; **malleable nails**, coffin nails, black, 35 to 40%; white lacquered and gilt, 25 to 30%; sacking; moulders' nails and chaplets, 1½ inch to 3 inch, 28/ to 29/; bright nuggets, 28/6 to 29/; tile pegs, 15/ to 16/ per cwt.; bright nails, 4/ to 5/ extra; tinned nails, 12/ to 13/ extra; galvanised nails, 10/ to 12/ extra; **nuts**, square forged, untapped, ¼ inch, /10 to 1/ per gross; ½ inch, 25/ to 26/ per cwt.; ¾ inch, 23/ to 24/ per cwt.; square forged nuts, tapped, ¼ inch, 1/2 to 1/4 per gross; ½ inch, 30/ to 32/; ¾ inch, 27/ to 29/; forged hexagon, untapped, ¼ inch, 1/10 to 2/; ½ inch, 32/ to 34/; ¾ inch, 27/ to 29/; forged hexagon, tapped, ¼ inch, 2/2 to 2/4; ½ inch, 39/ to 42/; ¾ inch, 31/ to 33/; machine-made nuts, square untapped, ½ inch, 20/ to 22/; ¾ inch 18/ to 20/; 1 inch, 18/ to 20/; square tapped, ½ inch, 25/ to 26/; ¾ inch, 23/ to 25/; 1 inch, 24/ to 26/; machine-made hexagon nuts, untapped, ½ inch, 21/ to 30/; ¾ inch, 22/ to 24/; 1 inch, 22/ to 24/; hexagon tapped, ½ inch, 35/ to 36/; ¾ inch, 30/ to 32/; 1 inch, 28/ to 30/.

Oddwork, tinned and black, 15 to 20%, list; **Paris pointes**, best English, 15/6 to 16/; foreign, 18/ to 20/; **planes**, 25 to 30%; iron **axle pulleys**, 1¼ inch, 12/6 to 18/; brass face axle pulleys, 28/ to 40/ per gross; B. F. and wheel, 48/ to 60/ per gross; brass escutcheon **pins**, ⅜ inch to 16 W. G., 1/ to 1/2 per lb.; bright gimp pins, ⅜ to 19 W. G., /6 to /8 per lb.; black, /7 to /9; brass 1/6 to 1/8 per lb. Japanned cut **gimp pins**, ⅜ inch, /7 to /8 per lb.; tinned, /8 to /9 per lb.; cut clog or coffin pins, japanned, ⅜ inch, /5 to /6; tinned, /7 to /8; brass pin pointes, 1/4 to 1/6; **plate locks**, fine 50 to 52½%; strong, 40 to 42½%; Lancashire plate locks, 25 to 30%; pewter measures, 30 to 35%.

Riddles, 30 to 35%; **Rivets**, iron boot rivets, /3½ to /4 per lb. patent machine-made Rivets, 30 to 35%; wrought tinmen's Rivets, 50 to 55%; round or panhead boiler Rivets, ¼ inch, 23/ to 24/; ⅜ inch, 18/ to 19/; ½ inch, 17/ to 18/; ¾ inch, 16/ to 17/. Delivered in London or Liverpool; machine-made wire Rivets, ¾ inch, 14/6 to 15/6 per cwt. **Rakes**, light garden Rakes 50 to 60%; light solid end Rakes, 47½ to 50%; bolstered teeth garden Rakes, 50%; solid end bolstered teeth garden Rakes, 40 to 45%.

Spades and Shovels, common, 52½/ to 55%; second, 35 to 40%; best 30 to 35%; best strong country Shovels; 25 to 30%; best hammered Spades and Shovels, 5 to 10%; **Ship Scrapers**, black steel blades, 45 to 50%; bright, 42½ to 47½%; cast-steel black, 42½ to 47½%; bright, 37½ to 42½%; best cast-steel black, 35 to 40%; bright, 30 to 35%; iron **Wood Screws**, 65%; brass wood Screws, 60 to 62½%; copper, 35 to 45%; Stove Screws, 50 to 57½%; dowel Screws, 60 to 65%; brass headlock Screws, 40 to 47%; gilt, silvered and plated head Screws, 40 to 45%; jute **Sash cord**, 52½ to 57½%; flax Sash-cord, 25 to 30%; best flax, 5 to 10%; super flax, 7½ to 12½%; extra super flax Sash-cord, 5 to 10%; patent steel ribbon **Sash-line**, 25 to 35%; copper **Sash-chain**, 52½ to 57½%; zinc Sash-chain, 47½ to 52½%; iron prepared, 40 to 45%; copper Sash-cord, 15 to 20%. **Sad irons**, common, 10/6 to 12 per cwt.; best japanned, 14/6 to 16/6; best best japanned, 18/ to 20/ per cwt.; **Shoe heels**, York, No. 1, 3/5 to 3/8; No. 2, 4/ to 4/3; No. 3, 8/ to 8/9 per gross net; Dundee hot turned, 5/9 to 6/3; bright-edge imperial or solid Scotch, 9/6 to 10/; bright York 61 B, 8/ to 8/6; bright solid, 6/6 to 7/; toe plates, 9/6 to 10/ per gross. **Stair rods**, turned ends, 75 to 80%; solid fancy ends, 60 to 65%; cased tube, 30 to 35%; patent solid ornamental, 35 to 40%. **Sofa Springs**, coppered, 8 by 6 inches, 25/ to 27/ per gross; 9 by 7 in, 21/6 to 23/6; 7 by 7 inches, 17/6 to 19/6 per gross; galvanised **Waterloo Scoops and hods**, 17/6 per doz.; japanned Waterloo scoops and hods, 16 inch, 15/ to 16/; japanned scoops and hods, light, 16 inch, 15 to 16/ per doz.; **Shutter bars**, common spring, broad and double, 75 to 77½%; Scotch iron drop, 77½ to 80%; brass drop, 70 to 72½%; brass drop and catch, 67½ to 70%; registered brass spring box shutter bars, 52½ to 67½%; double-handed brass spring box, 57½ to 65%; **Saddlers' tools**, 5 to 10%; **Stocks and Dies** for smiths' use, 35 to 40%; ditto for engineers, 10 to 20%; **Steel toys**, 10 to 30%.

Traps, bow spring, sham Dorset and real Dorset rabbit traps, 45 to 65%, list prices; common traps, 4 inch, 5/6 to 8/ per doz. net; run traps, 2½ inch, 4/ to 8/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/; axle bridge, 1/4 per lb., 40 to 45%; hawk or pole traps, 54 to 60%; wrought mole traps, japanned, 2/6 to 3/9; galvanised, 3/9 to 4/9. **Tin plates**, I C, 30/ to 32/. **Tinmen's machines** and tools, 5%; brass **Bell Tube**, ⅜ inch and upwards, 1/ to 1/1 per lb.; copper bell Tube, 1/2 to 1/4 per lb.; zinc bell Tube, 45 to 50% list; **Patent cased Tube**, 45 to 50%; cut to lengths, 40 to 45%; burnished and lacquered brass tube, 30 to 35%; polished and lacquered twisted brass tube, 30 to 35%; patent taper iron tube, 30 to 35%; patent cased taper iron tube, 30 to 35%; parallel iron brased tube, 30 to 35%; twisted iron parallel tube, 30 to 35%; patent cased twisted iron parallel tube, 30 to 35%; iron **Gas Tubes**, 65 to 67½%; fittings, 67½ to 70%; iron **Water Tubes**, 55 to 57½%; fittings, 57½ to 60%; iron **Steam Tubes**, 50 to 52½%; fittings, 52½ to 55%; galvanised iron gas Tubes, 50 to 57½%; fittings, 52½ to 55%; lap-welded **Boiler Tubes**, 52½ to 55%, delivered in London, Liverpool or Glasgow; table catches, 36 to 40%; ditto, improved brass follow, 20 to 25%; wrought japanned **Tea kettles**, 50 to 60%; galvanised **Turnip skips**, 21 inches, light, 25/ to 26/ per doz.

Vices, common black, 32/ to 34/ per cwt.; common bright, 40/ to 42/ per cwt.; black staples vices, solid box black, 42 to 48/; bright, 41/ to 47/; solid box, black staple, with spherical washer, 40/ to 45/; bright 41/ to 55/.

Washers, light iron, 72½%; heavy washers, 13 to 16 lb., W.G., 12/ to 12/6 per cwt.; ¼ inch thick, 2/ per cwt. extra; 5-16 inch, 3/; ⅜ inch 4/; shook bright washers, 3/ to 3/6 per cwt. extra; **Wall hooks**, 23/ to 25/ per cwt.; **Washing tubs**, galvanised oval, 22 inch, 19/ to 30/; 24 inch, 34/ to 35/; round, 22 inch, 38/ to 40/; **Water bowls**, hammered, list price, 52½ to 57½%; light seamed 9 inch, 8/ per dozen; light wired 9 inch, stamped, 11/ to 12/; **Wove wire** list price, iron, copper and brass, 45 to 50%; iron **Wire**, bright, 0 to 6, 14/6 to 15/6 per cwt.; galvanised, 18/6 to 19/6; fine galvanised iron wire, No. 23, 5/3 to 5/6 per stone 14 lb.; annealed tinned wire No. 18, 4/ to 4/3 per stone 14 lb.; cut tinned bottling wire, No. 22, 4/11 to 5/0 per stone 14 lb.; weaving and binding wire, No. 23, 4/ to 4/2 per stone 14 lb.; bright or annealed fine wire, 23, 5/7 to 5/9 per stone 14 lb. net; cast steel wire, 0 to 6, /9½ per lb.; 10 to 20%; metallic or horticultural wire, 6 to 14, /5½ to /6½ per lb; No. 15, 5¼ to /6; 16 to 20, /5½ to /6½; in 1 lb. rings, 1¼ inch diameter, /½ per lb. extra; prepared bright **fencing Wire**, 0 to 6, 14/6 to 15/ per cwt.; annealed drawn fencing wire, 0 to 6, 13/3 to 14/3; annealed drawn galvanised, 0 to 6, 17/6 to 18/6. Bright or annealed steel, 0 to 6, round or oval 16/9 to 17/9 per cwt.; black rolled, 1 to 4, 11/6 to 12/6 per cwt.; galvanised rolled, 1 to 4, 14/9 to 15/9 per cwt.

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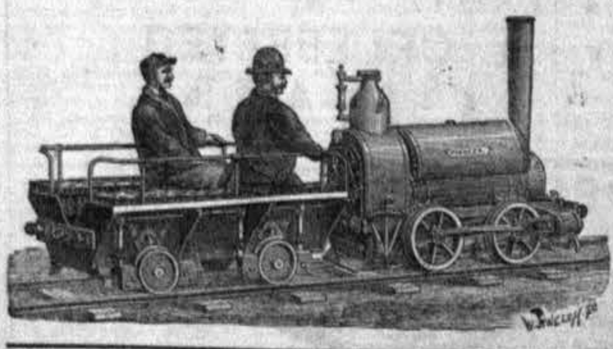

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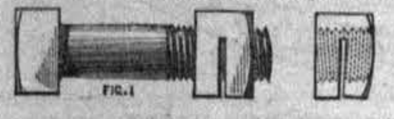
FIG. 1

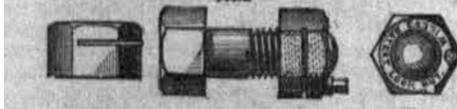
FIG. 2

The advantages of this Lock Nut are as follows:—Simplicity, cheapness, strength, locking on any portion of the bolt without injuring the thread. Fig. 1A shows a RAILWAY FISH NUT with saw-cut partially closed, having been previously tapped, and it is only necessary to screw it upon the bolt in the ordinary manner, when the cut opens and exerts a sufficiently strong spring friction to secure the nut from slacking back by vibration. Fig. 2 shows a nut fitted with set screw, which is more applicable to steam engines and other machinery, especially when the nuts are above 1 inch in diameter, but below that size it is recommended that they should be of steel and applied in the same manner as the fish nut, thereby dispensing with the set screw.

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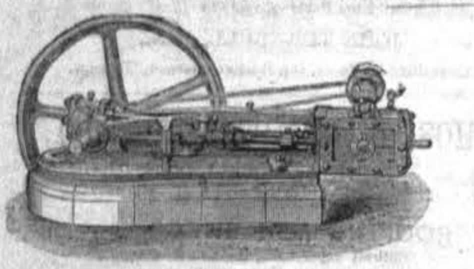

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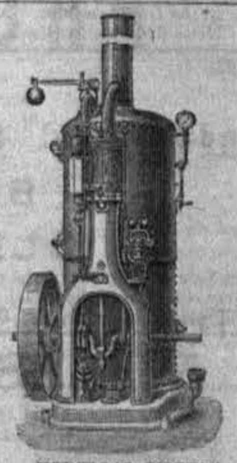

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5 × 3½	2 × 2	4 × 3 = 12 ,,	6 × 3 = 16 ,,	8 × 5 = 29 ,,	10 × 5 = 36 ,,	16 × 6 = 62 ,,	3 × 3	8 × 3¼
4 × 3	1½ × 1½	5 × 2 = 8 ,,	6 × 5 = 29 ,,	8 × 6 = 34 ,,	10 × 6 = 54 ,,	18 × 6½ = 82 ,,	2½ × 2½	6 × 2½
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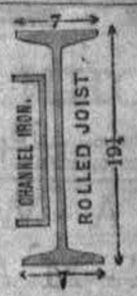

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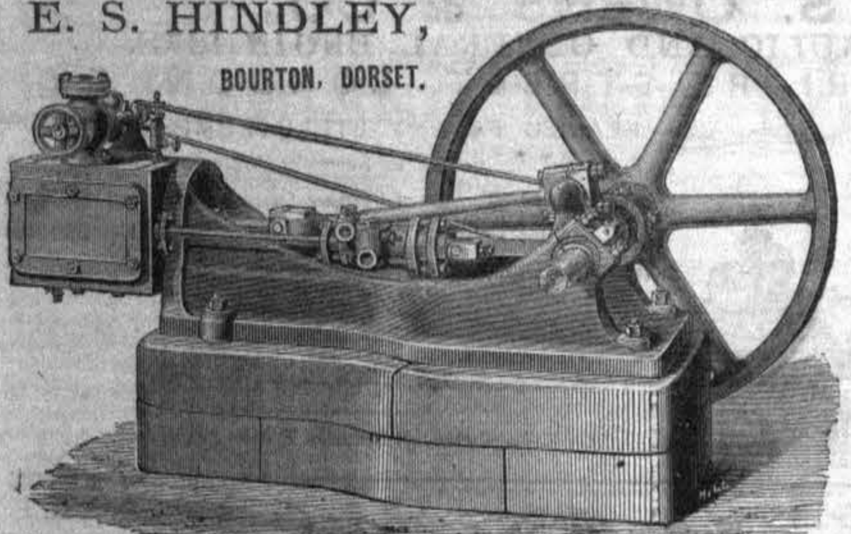

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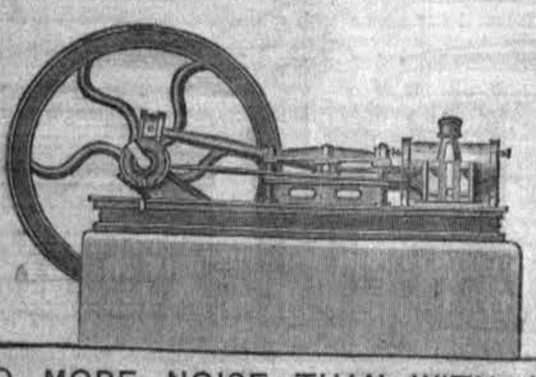

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Running Over a Man.—"Telling of going through this drove of sheep at the crossing," continued Jackey, "calls to mind—indeed I can never forget it—the time I run into that horse and wagon with a man and two ladies in it, at the crossing between Greycourt and Oxford. It was the most harrowing spectacle I ever witnessed on the road, and God forbid that I should ever witness another one. I was westward bound down Oxford grade, one of the worst on the road, with a full train of empties and going like the d—l. All of a sudden my eyes lit on the man trying to get his horse over before I reached him. I blew and tooted and rang the bell, and as I neared him my heart went up. The horse balked or was frightened, I don't know which, and for once I lost my balance. My nerves completely left me, and I was as helpless as a child. I knew I couldn't stop the big train I had behind, but I called for brakes and reversed with the hopes of averting a calamity; but 'twas no use. I was certain I was going to kill every one in the wagon and the horse too, and when I hit them I swooned. 'Twas the most terrible experience I have ever had since I run an engine. The two ladies seemed as if charmed and were perfectly unconscious of their great danger, while the man was beating the animal in a fearful way to get him to pull across out of the way. They all had their eyes riveted on the train, and although it was running them down every second faster and faster, not one of them made a move to jump from the wagon. When I struck them, they had not moved a step from the spot where I first saw them. When the train stopped I got settled, but could hardly recall what I had just seen. My fireman says: 'Let's go back and see if they are killed;' but I couldn't stand it, and didn't go back. It turned out happily that the only one killed was the horse who had balked. When the engine hit him he was directly between the two rails, and being struck with such force, broke loose from the wagon and was sent 20 feet in the air, landing in a culvert with his neck broken and mutilated in a horrible manner. The man and the two ladies were more frightened, like myself, than hurt. They were all pitched with the wagon into the gutter on the side of the track, and beyond being roughly handled and receiving several scratches and bruises, nothing serious befell them. Oh, yes, I forgot the man's arm was broken. The nearest house was opened to them, and we went on, I being unstrung and hardly capable of running the rest of the trip. I tell you I will never forget that experience, and several times since it happened the horrible sight has come to me in my dreams."—*Honesdale (Pa.) Herald.*

FOR MINING, ENGINEERING AND GENERAL MECHANICAL PURPOSES

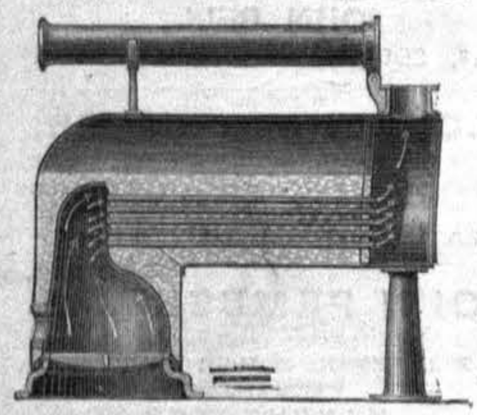
LEATHER INDIA-RUBBER GUTTA-PERCHA

GEO. ANGUS & Co. NEWCASTLE-ON-TYNE AND LIVERPOOL.

PATENT LAUNCH BOILERS,

With Circular Fire-boxes.

NO STAYS IN FIRE-BOX.



Advantages.—Less First Cost. Great Strength. Increased Facility for Cleaning. Freedom of Expansion.

J. BLAKE,
BRIDGEWATER IRON WORKS,
Prussia St., Oldham Road, Manchester.

MEMORANDUM FOR GAS COMPANIES.

TORBAY AND DART PAINT CO. (LIMITED).

Sole Proprietors and Manufacturers of

WOLSTON'S

TORBAY PAINTS.

Offices—23, Great George Street, Westminster London, S.W.

Works — Dartmouth and Brixham, Devon.

TRADE MARK.

These celebrated Paints are now very generally acknowledged to be the best and most economical in use. Gas Companies especially have, by experience, proved that no others so fully meet their peculiar requirements, as they are not only unaffected by great heat and effectually resist Sulphuretted Hydrogen, Ammonia, &c., &c., but they may be applied to Gasholders that have hitherto been covered with the unsightly coal tar. They are also cheaper than other paints and compositions; two coats of genuine Wolston's Torbay Paint being equal in covering power to three of lead paint, or any of the numerous low-priced spurious oxides that are now in the market, whilst the durability of Wolston's is unrivalled.

The colours most approved for Gasholders, Purifiers, Scrubbers, and all the plant and machinery used in and about Gas-Works, are—

For Dark Tints.

No.	per Cwt.	No.	per Cwt.
13. Torbay Red	34s.	8. Bronze Green	36s.
6. Dart Brown	34s.	16. Torbay Chocolate...	34s.
10. Carriage Red... ...	34s.	4. Brixham Black ...	32s.
1. Torbay Brown ...	30s.		

For Light Tints.

No.	per Cwt.	No.	per Cwt.
7. Imperial Stone ...	34s.	19. Light Stone	36s.
20. Portlane Stone ...	38s.	30. Bath Stone	38s.
31. Gray Stone	38s.	38. Buff	35s.

These Prices are for Paints in paste, carriage paid to any Gas-works in Great Britain, in consignments of not less than 5 cwt.; but all the above colours may be had, ready mixed for the brush, in various-sized paint cans with handles at a uniform price of 56s. per cwt. (6d. per lb.) carriage paid as above, in consignments of not less than 2 cwt., the sizes being 3 lb., 7 lb., 14 lb., and 28 lb. By taking the Paints in this convenient form, a considerable saving is effected in time, &c., as they can be immediately applied by any workman without the intervention of skilled painters to mix and prepare them; besides which all waste is avoided, and they may always be relied on as containing no adulterating or inferior material.

Where light colours are preferred, the works should be primed with two coats of No. 7, and finished with either of the other stone colours; and when the dark colours are selected, a priming coat of No. 13 is recommended.

Specimen Cards forwarded and Inquiries attended to on application to

23, GREAT GEORGE STREET, WESTMINSTER, LONDON.

JOHN H. AUSTIN AND CO.,

90, CANNON STREET, LONDON, E.C.,

SUPPLY EVERY DESCRIPTION OF

RAILWAY MATERIAL.

MINING COMPANIES, CONTRACTORS AND OTHERS are requested to send full particulars of their requirements, large or small.

OLD RAILS AND WROUGHT OR CAST SCRAP FOR EXPORT.

STEEL OR IRON RAILS, BESSEMER CROP ENDS, OLD STEEL RAILS, &c.

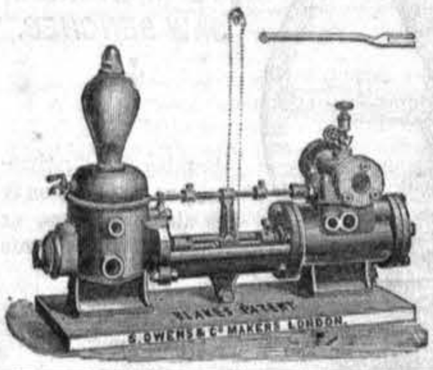
BLAKE'S PATENT DIRECT-ACTING STEAM PUMP

SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN:

S. OWENS & CO.,

HYDRAULIC AND GENERAL ENGINEERS,

WHITEFRIARS STREET, LONDON, E.C.



BLAKE'S PATENT STEAM-PUMPS are suitable for Boiler Feeding, for use in Ironworks, Waterworks and Mines, for working Hydraulic Lifts and Presses, for compressing and exhausting Air, and for a variety of other purposes. They are simple and thoroughly reliable in their action, and will work with equal certainty at slow or quick speeds.

MORE THAN 10,000 IN USE.

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THE OAKBANK *Steam Cylinder and Valve Oils,*

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For the Internal Lubrication of Surface-Condensing Marine and Land Engines.

RECEIVED HONOURABLE MENTION PARIS EXHIBITION, 1878.

Pure Mineral Oils, Greatest Lubricating Power in the Market, and not decomposed at 600° Fahr.

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SOLE MANUFACTURERS,

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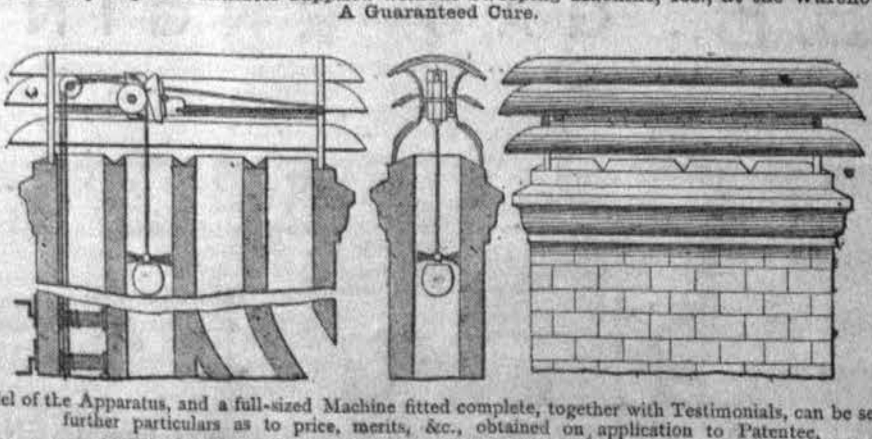
PATENT DESIDERATUM

FOR SMOKY CHIMNEYS, AND SWEEPING MACHINE.

The Chimney Cap or Ventilator supplied without Sweeping Machine, 15s., at the Warehouse. A Guaranteed Cure.



A Model of the Apparatus, and a full-sized Machine fitted complete, together with Testimonials, can be seen, and further particulars as to price, merits, &c., obtained on application to Patentee,

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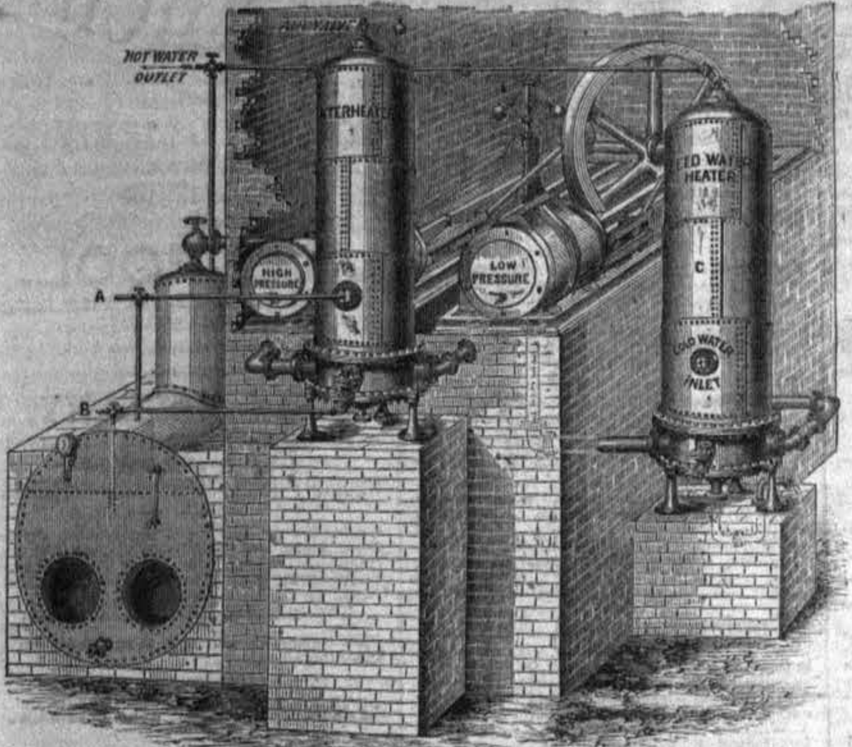

Neptune Forge, Engine and Boiler Works,

TIPTON, STAFFORDSHIRE

And at 147, QUEEN VICTORIA STREET, LONDON, E.C.,
Sole Makers of Berryman's Improved Patent

UNIVERSAL EXPANDING BRASS TUBULAR HEATER,

AS APPLIED TO HIGH-PRESSURE, CONDENSING AND

COMPOUND ENGINES LAND AND MARINE.

The great success which has attended the introduction of these Celebrated Heaters to High Pressure has led to their being applied to Condensing Engines also, and as Interheaters for Compound Engines—Stationary and Marine; and from actual experience J. W. and Co. have now reliable information as to the precise amount of Saving in Boiler Mending and Coal which can be realised by the judicious use of Exhaust steam from High Pressure, Condensing or Compound Engines with these justly

CELEBRATED BERRYMAN HEATERS.

The Interheater shown in the above sketch is fixed at any convenient distance from the Cylinders in or outside the Engine-room. The Exhaust steam from the High Pressure Cylinder is passed through the inside of the Solid-drawn Bent Brass Tubes in the Interheater, and thence into the Steam Chest of the Low Pressure Cylinders.

N.B.—The application of these Heaters to Compound Engines largely increases the effective power, especially where Engines are under their work, and they can be added to any existing plant.

AS INTERHEATERS & FEEDWATER HEATERS,

56 ARE NOW IN USE IN GREAT BRITAIN AND IRELAND EFFECTING VERY GREAT SAVING. ILLUSTRATED PRICES AND TESTIMONIALS on application to the Works.

GALVANISED IRON ROOFS AND BUILDINGS.

General Store for Wharf, &c.

The system adopted by F. M. and Co., in the Construction of their Galvanised Corrugated Iron Buildings combines many advantages which no other form of building can offer. At a minimum cost they provide every required accommodation, while the construction secures great strength and durability, together with protection against fire. Illustrated Catalogues and Estimates sent on application when Purchasers should supply full particulars of requirements.

Francis Morton and Co.,
LIMITED.
ESTABLISHED OVER THIRTY YEARS.

Open Shed for Covering Large Areas.

NAYLOR STREET IRONWORKS, LIVERPOOL. LONDON OFFICE: 1, DELAHAY STREET, WESTMINSTER.

HENRY POOLEY AND SON.

PRIZE MEDALS.

London	1851
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Paris (class 63)	1867
Naples	1871
Trieste	1871
Moscow (Gold)	1872
Moscow (Silver)	1872
Brussels (do.)	1876

Sole Makers of
POOLEY'S PATENT
SELF-INDICATING
and
TURNTABLE
WEIGHING MACHINES
for
PIT BANKS.

Manchester and Liverpool ..	1867
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(Society for Promoting Scientific Industry)	
Ayrshire	1876
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TRAMWAY
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Improved Indicators
for
BILLY FAIRPLAY
MACHINES.

Patentees and Sole Makers of

POOLEY'S WEIGHING MACHINES,

For all Commercial, Manufacturing, Railway and Mining Uses.

ADAPTED TO THE STANDARDS OF ALL NATIONS.

WORKS:—ALBION FOUNDRY, LIVERPOOL.

Fleet Street, LONDON, E.C.
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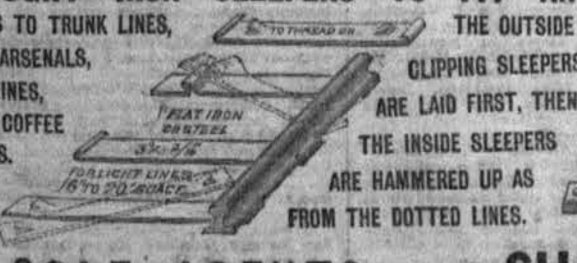
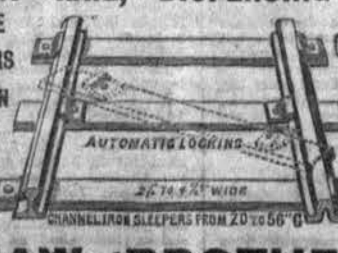
A NARROW GAUGE RAILWAY —**LEGRAND'S PATENT**— COMPLETE IN TWO PARTS, From £250 per Mil

WROUGHT IRON SLEEPERS TO FIT ANY RAIL, DISPENSING WITH SPIKES AND ALL LOOSE PIECES.

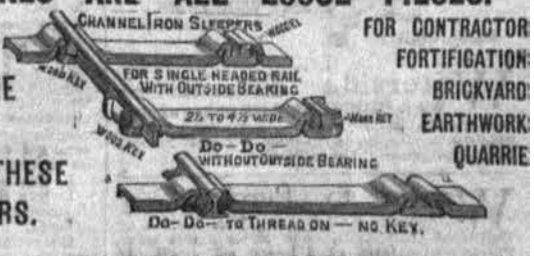
FOR FEEDERS TO TRUNK LINES, QUAYSIDES, ARSENALS, FORESTS, MINES, SUGAR AND COFFEE PLANTATIONS.



THE OUTSIDE CLIPPING SLEEPERS ARE LAID FIRST, THEN THE INSIDE SLEEPERS ARE HAMMERED UP AS FROM THE DOTTED LINES.



OVER 1000 MILES OF LINE ARE NOW LAID WITH THESE SLEEPERS.


CHANNEL IRON SLEEPERS
WOOD KEY
FOR SINGLE HEADED RAIL WITH OUTSIDE BEARING
2½ TO 4½ WIDE
WOOD KEY
Do–Do– WITHOUT OUTSIDE BEARING
Do–Do– TO THREAD ON — NO KEY.

FOR CONTRACTOR FORTIFICATION BRICKYARD EARTHWORK QUARRIE

SOLE AGENTS, **SHAW BROTHERS,** BIRMINGHAM.

DRAWINGS & PARTICULARS ON APPLICATION. TO SAVE TIME, PLEASE GIVE GAUGE, WEIGHT OF RAIL AND KIND OF TRAFFIC

Two Silver Medals, Paris, 1878.
The Chilian Medal, Santiago, 1875.

THE GLENBOIG STAR FIREBRICK WORKS,

Near COATBRIDGE, N.B.

JAS. DUNNACHIE,
2, *West Regent Street, Glasgow.*

Contractor to Her Majesty's Government.

Manufacturer of Fire Bricks for Steel, Iron, Brass, Gas, Chemical and Glass Furnaces, Copper roasting, calcining and refining furnaces. The special bricks for the Siemens regenerative gas-furnace (this is the brand recommended by Dr. C. W. Siemens). Bessemer tuyeres, runners, plugs and stoppers. German tubes. Gannister of highest quality, ground fireclay. No other firebrick combines such a high degree of infusibility with the perfect absence of cracking and splitting up under sudden cooling.

Each brick bears the registered Trade Mark.

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Quotations, Illustrated Catalogues, &c., on application.

Shipping ports, Glasgow, Grangemouth, Leith, Granton, Boness, &c.

London Agents: Messrs. Doulton and Co., Lambeth Pottery, and Crown Wharf, Victoria Park, E.

Wheatley Kirk, Price and GOULTY. Established 1850. MECHANICAL VALUERS, AUCTIONEERS AND ARBITRATORS.

Head Offices—Albert Square, Manchester.

Partnerships. — Gentlemen (Practical Engineers) desirous of entering established Engineering concerns, are invited to communicate with the undersigned, who have numerous bona fide establishments open to admit such. References are given and required.—Wheatley Kirk, Price and Goulty, Albert Square, Manchester.

Engineering Firms of Good REPUTE, open to admit partners, or desirous of selling outright, are requested to communicate with the undersigned, who have numerous clients open for such.—Wheatley Kirk, Price and Goulty, Albert Square, Manchester.

By order of the Devisee in Trust under the will of the late Wm. James, Esq.—Gloucestershire, in the Forest of Dean.—Valuable Mining Properties, extending over about 200 acres (of which about 25 acres have been partially worked), and containing an abundance of hematite iron ore of rich quality, yielding a very high percentage of pure metal, together with the joint ownership with Messrs. Henry Crawshay and Sons of a private tramway, communicating direct with the Severn and Wye Railway.

Messrs. Debenham, Tewson, FARMER and BRIDGEWATER will SELL, at the Mart, on TUESDAY, May 11th, at 2, in three lots (unless an acceptable offer or offers be previously made), the following important IRON MINES:—

Lot 1.—The Oakwood Mill Deep Level, situate near Bream, in the hundred of St. Briavels, about two miles from Lydney and three from Coleford. Held under an award from the Crown for 500 years from March, 1825, at a dead rent of £15 per annum and a royalty at 4d. per ton on all ore raised in excess of 900 tons per annum. A portion of this lot—viz. the Upper and Lower Sandstone Levels, is sub-leased for seven years, at a dead rent of £200 per annum, and a royalty of 1s. 9d. per ton upon all in excess of 2285 tons per annum. The remainder is in hand. Also an undivided Moiety of the Oakwood Tramway, a valuable property, 1¾ mile in length, from which a considerable income is derived in the shape of tolls.

Lot 2.—The Scar Pit, a freehold grant or gale from the Crown, overlying a portion of the Oakwood Deep Level Mine. This lot is subject to a dead rent of £5 per annum, and a royalty of 4d. per ton on all over 300 tons per annum. With possession.

Lot 3.—The Frog Pit, a freehold grant or gale from the Crown, overlying a portion of the Oakwood Deep Level Mine. Dead rent £5 per annum, royalty 4d. per ton on all exceeding 300 tons per annum. With possession.

The mines are adjacent to the extensive works of Messrs. Henry Crawshay and Sons, at Parkend. Particulars may be obtained of W. Caister, Esq., Solicitor, 8, New-inn, Strand; and of the Auctioneers, No. 80, Cheapside.

MIDLAND RAILWAY.

TENDERS FOR LOCOMOTIVE ENGINES.

The Directors are prepared to receive Tenders for the supply of 20 PASSENGER and 20 GOODS ENGINES.

Plans may be seen and specifications obtained, by principals only, upon application to Mr. S. W. Johnson, Locomotive Superintendent, Derby, on and after Friday, April 23rd, 1880.

The Tenders to be sent in addressed, "To the Secretary of the Locomotive Committee, Midland Railway, Derby," and to be received not later than 9 a.m. on TUESDAY, May 4th, 1880.

The Directors do not bind themselves to accept the lowest or any Tender.

JAMES WILLIAMS,
Secretary.

Derby, April 14th 1880.

Waterside Premises. — WAREHOUSES to LET with or without frontage to River Thames, in portions to suit applicants.—Apply, 4, Upper Thames Street, London, opposite "Times" Office.

Wanted to Purchase, a quantity of OLD DOUBLE LEAD, or Bull Head Steel Rails, none under 2 feet long. Please send quantities and lowest price to B. M. Renton, Iron and Steel Merchant, Sheffield.

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200 TONS NUTS, BOLTS, &c.,
ALWAYS IN STOCK.
SAMUEL MARSDEN & SON.
LONDON ROAD, MANCHESTER.
Patentees and Makers of Special Machinery for Bolt, Spike and Nut Making.

BY ORDER OF THE SECRETARY OF STATE FOR INDIA IN COUNCIL.

The Director-General of STORES FOR INDIA is prepared to receive TENDERS from such persons as may be willing to SUPPLY ANGLE, ROUND, FLAT, HOOP, and SQUARE IRON.

The Conditions of Contract may be obtained on application to the Director-General of Stores, India Office, Westminster, S.W., and Tenders are to be left at his office at any time before two o'clock p.m. on the 20th day of April, 1880, after which no Tender will be received.

A. ABERCROMBIE JOBB,
Director-General of Stores.

India Office, 13th April, 1880.

For Sale, about 250 Tons BESSEMER STEEL, consisting Ingot Ends, &c.—

60 Tons 30 W STEEL RAILS, new.
50 " 40 " " " "
25 " 42 " " " "
20 " 50 " " " "
70 " 45 D IRON RAILS, new.
150 " 40 " " " "
40 " 35 " " " "
80 " 56 " " " "

With all Fastenings complete if required.—Apply, "Rails," Office of this Journal.

Borough of Liverpool.— TRAMWAYS RECONSTRUCTION and EXTENSION.

TENDERS are invited for the SUPPLY of the following MATERIALS required for the RECONSTRUCTION and EXTENSION of the Liverpool Corporation Tramways (except the Inner Circle), comprising 15 miles 3 furlongs, or thereabouts, viz:—

(a) BESSEMER STEEL RAILS.
(b) CAST IRON SLEEPERS, POINTS, and HOLDING-DOWN JAWS.
(c) PHOSPHOR BRONZE SCREWED BOLTS and WROUGHT IRON NUTS.

Tenders will be received for the whole, or for any of the parts separately, in accordance with specifications, drawings, and forms of Tender, which can be seen, and copies obtained, on application to the Borough Engineer, Municipal Offices, Liverpool, on and after Monday, the 5th April next, on payment of one guinea, which will be returned on receipt of a bona-fide Tender and the return of the documents.

Tenders, which are to be on the printed form, and endorsed "Tramways Reconstruction, Tender for (a), (b), or (c)," to be addressed to the Chairman of the Health Committee, and delivered at the Borough Engineer's Office, Municipal Offices, Liverpool, not later than Wednesday, the 21st day of April, 1880.

The person whose Tender is accepted will be required to enter into a contract to be prepared by the Town Clerk.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JOSEPH RAYNER,
Town Clerk.

IN LIQUIDATION.

To be Sold by Private TREATY, as a going concern, on the Great Northern Line of Railway, a well-established ENGINEERING BUSINESS, comprising the following branches, viz:—

The Manufacture of Stationary Engines and Boilers.

Portable and Combined do.

Agricultural Implements of all classes,

And especially the Manufacture of Wrought Iron Cranks, for which a complete Plant of Patent Machinery has been put down; also General Iron Founding with all the Appliances for carrying on and extending a first-class trade.

The Machinery and Tools are by well-known makers, and the new Buildings are erected upon land secured on a 999 years' lease.

Full particulars can be obtained from Mr. Isaac Jenks, of Wolverhampton; Mr. Thomas Leman, Accountant, Nottingham; or Messrs. Corser, Fowler and Langley, Solicitors, Wolverhampton.

To be Let or Sold, the IronSTONE on the Brumby Estate, belonging to the Earl Beauchamp, near Frodingham Station, in North Lincolnshire.

The Frodingham Bed extends over 260 acres of this property, and lies immediately below the soil. It is estimated that these 260 acres contain upwards of 5,000,000 tons of Ironstone. The analyses give a high per centage of iron. The estate is only 400 yards distant from the Doncaster and Grimsby Branch of the Manchester, Sheffield, and Lincolnshire Railway, a connecting line with which Lord Beauchamp has power to make.

For further particulars, apply to Messrs. Walford, 27, Bolton Street, Piccadilly, London.

AVIS IMPORTANT.

Le Journal "Iron" (le Fer) traite de toutes les matières relatanr au Commerce et à la fabrication du fer. Il donne les prix-courants des spécialités de Birmingham, Sheffield et districts voisins. Les colonnes en sont ouvertes aux rapports scientifiques et commerciaux publiés sur les métaux et sur la quincaillerie de tous les pays du monde. On y trouvera des comptes rendus et des appréciations étendues sur la fabrication du fer et sur toutes matières ayant rapport à la métallurgie, aux hauts-fourneaux, etc., ainsi que des descriptions variées sur les diverses usines. Le journal "le Fer" ayant une circulation considérable parmi les manufacturiers, négociants et exportateurs des deux continents est de la plus haute importance pour tous ceux qui ont à insérer des annonces industrielles ou métallurgiques.

Le journal se publie tous les Vendredis.

Le prix du numéro est de 0f. 60 c. et le coû de l'abonnement est de 38 f. par an., frais de port compris.

On est prié d'adresser toutes communications au Directeur de l'Iron, No. 161, Fleet Street, London, E.C.

H. AUGUSTUS GUY AND COMPANY,
Government Contractors and Medallist
STEEL CONVERTERS AND REFINERS.
Sole proprietors and manufacturers of
GUY'S 'INVINCIBLE,' 'RELIABLE,' & 'MINING' TOOL STEEL.

Steel Forgings and Castings of every weight and Section.

The unequalled exellence and undeviating uniformity of these famous Brands secure an immense economy in the workshop and the mine.

Inventors and Sole Makers of the

"IMPERIAL" METAL.

An economical and efficient substitute for ordinary brass and gun metal, being much more durable and cheaper than these materials.

GUY'S "TRUE" BOILER CLEANER & FUEL ECONOMISER.

For removing and preventing incrustations in land and marine boilers. It prevents oxidation, secures a material saving in fuel, and doubles the life of the Boiler.

Chief Offices:
11, CLOAK LANE, CANNON STREET, LONDON, E.C.

Works.—The "Imperial" Metal and Steel Works Peckham, London, S.E., and Sheffield.

Full descriptive price Lists on application.

Wanted, a Working PartNER, to represent in London a well-established first-class works, manufacturing Girder Bridges and other ironwork. Applications entertained from principals only. Capital required £4000.—Address, H. O. C., St. Stephen's Chambers, Telegraph Street, Moorgate Street, E.C.

Engineering. — A MechanICAL and Civil Engineer, with experience in England and on the Continent, desires to enter an engineering establishment (London preferred), with a view to partnership. Could introduce at once capital against mortgage security.—Address, A. W., care of James Bird, Esq., 2, Lawrence Pountney Hill, Cannon Street, E.C.

OIL SUPERSEDED!
NO MORE MESS. NO MORE WASTE.

BLIVEN'S AMERICAN
LUBRICATING CREAM
Unrivalled for Economy, Efficiency and Cleanliness.
For Marine and Stationary Engines Mill Shafting, &c., &c.

EXTRACTS FROM TESTIMONIALS.

"We are very much pleased with it. Apart from the large saving effected, it is much cleaner, and takes less time and labour than in attending to the oiling of bearings. Tests show 6/8 for Cream, against 45/- for Oil.
"THOMAS BRASSEY and Co., Birkenhead."

"The tests with shaft journals in the joinery department, working at very high speed, show results especially favourable.
"LAIRD BROTHERS, Birkenhead."

"It has given us unqualified satisfaction. Requires much less attention than oil, and is perfectly clean.
"JAMES TAYLOR and Co., Birkenhead."

"We find it to be the most efficient, economical and cleanly lubricant we have hitherto used.
"ALEX. CRICHTON,
"Manager Cork S.S. Company, Liverpool."

"It is the most efficient lubricant we have ever tried.
"J. H. WILSON and Co., Liverpool."

"We enclose order for one ton, which is the best proof we can give you of our satisfaction.
"JAMES HUMPHRYS,
"Manager Barrow Shipbuilding Company (Limited)."

"Work is considerably lessened, and 65 to 70 per cent. is saved.
"JAMES MacLAY,
"Chief Engineer S.S. 'Albicore,' Granger."

Agents wanted. Trade Mark a Lubricator. Beware of imitations.

Sole Agency for Great Britain.

3. George's Dock Gates, Liverpool.

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Maschinen-Constructeur.

Zeitschrift für Maschinen-und Mühlenbauer, Ingenieure und Fabrikanten.
Unter Mitwirkung bewahrter Ingenieure und anderer Fachmanner des Inund Auslandes
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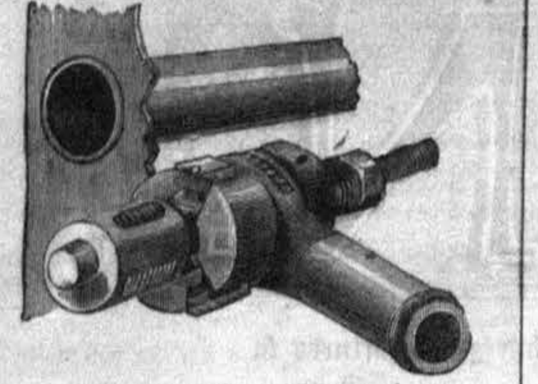

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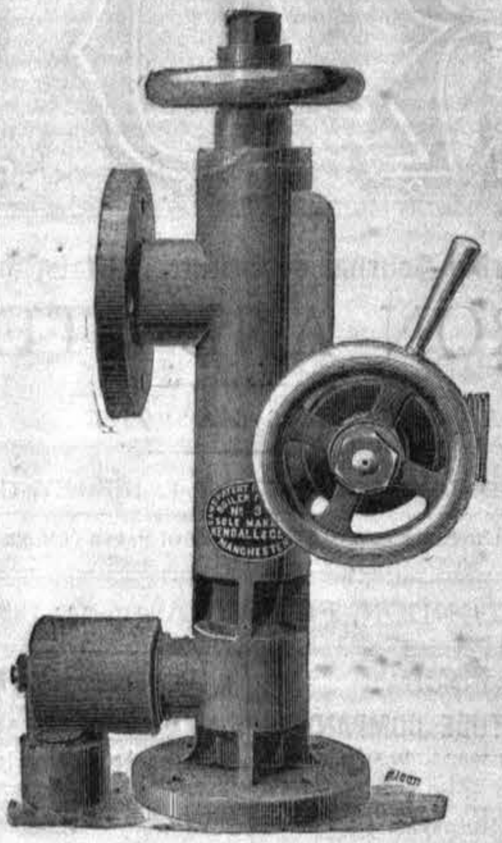

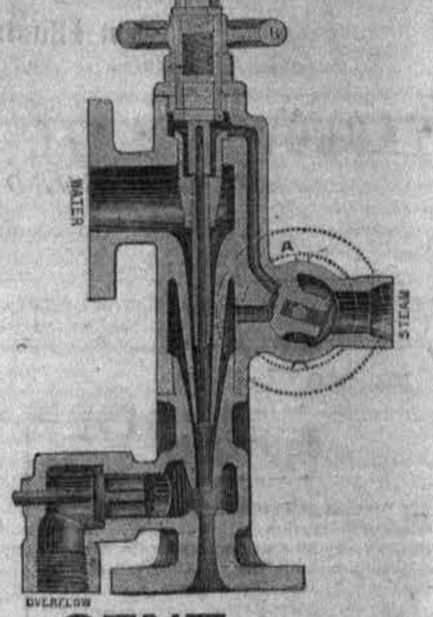

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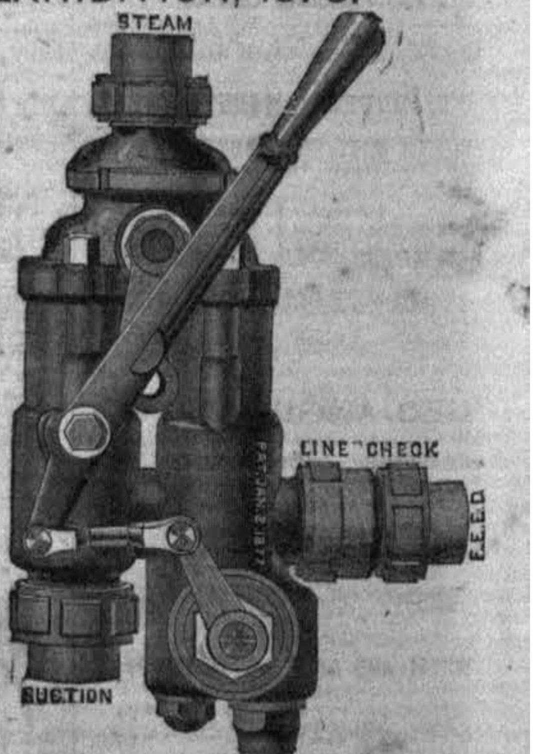

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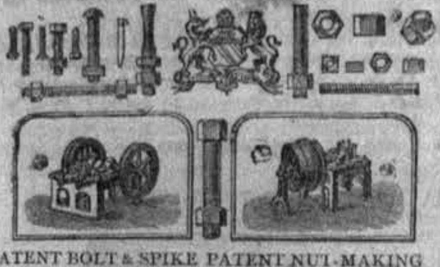

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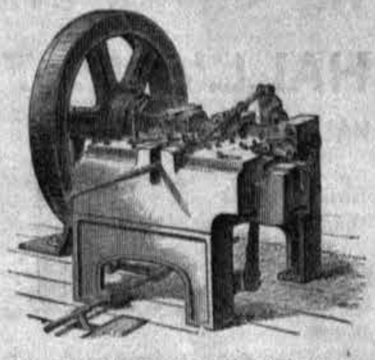

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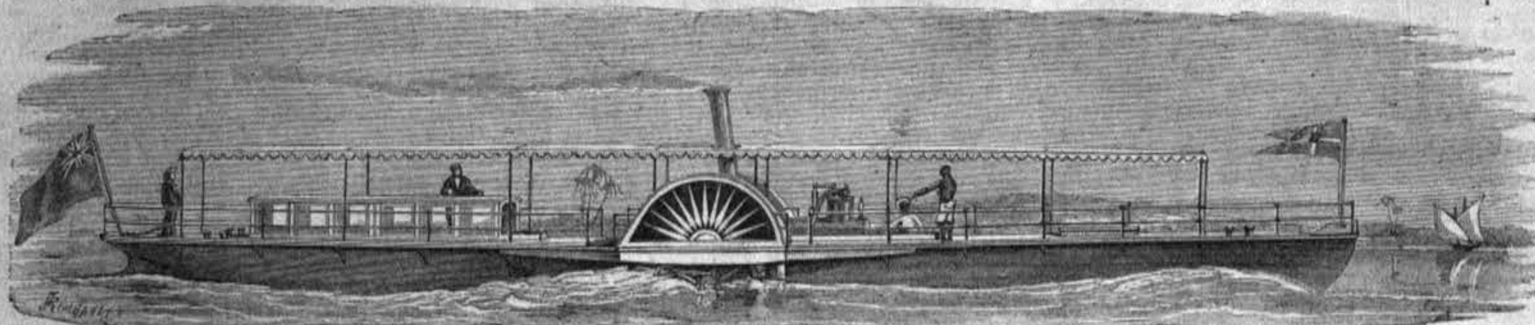

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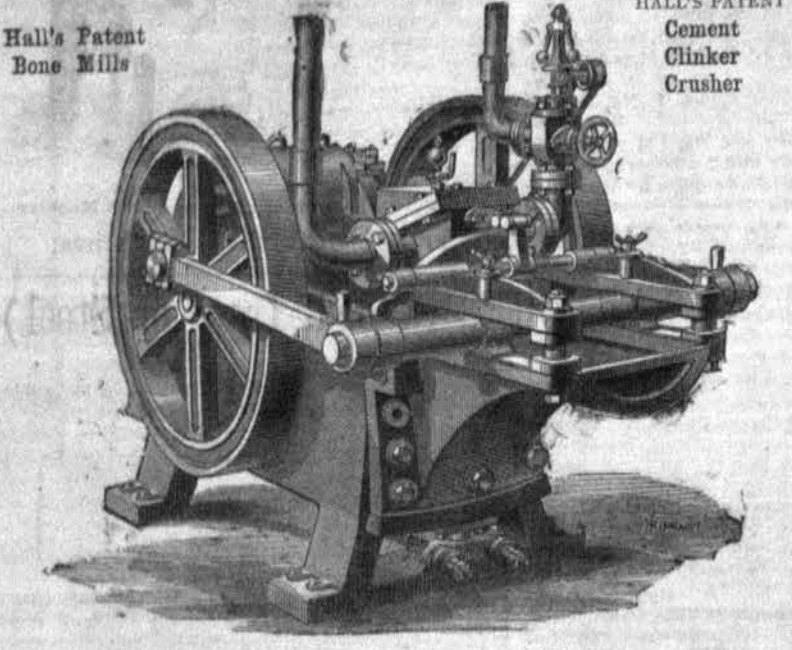

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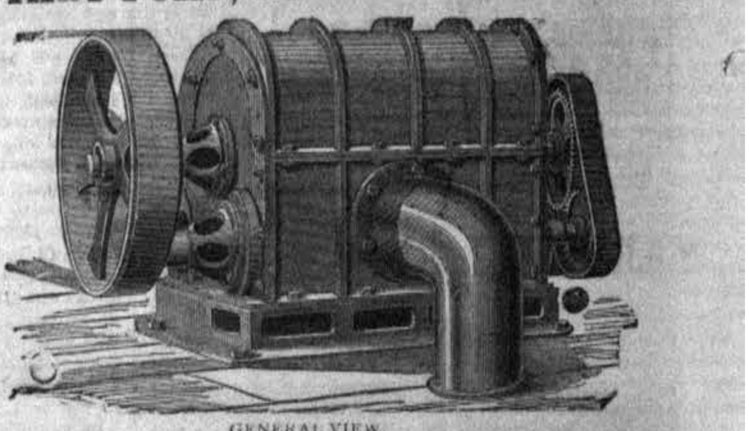


GENERAL VIEW.

This Blower is adapted for Cupolas, Smiths' Fires, Ore Hearths, Slag Hearths, Refineries, &c., &c., also for Ventilating Coal and other Mines, Ships, Buildings, Railway Tunnels, Drying Rooms, and generally for elevating Grain, Timber, Sugar, &c.

ITS ADVANTAGES ARE

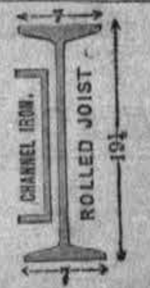
Fewness of parts—Less pulsation than any of its class—Capability of running direct from an Engine—Not being affected internally by wearing of gears—Requiring no lubrication internally, and no dubbing to make it temporarily tight—Exhausting as well as blowing—Non-injury from dust—Steady running, without jerking belts—Unchangeability in power from damp—Blowing hot and cold equally well—Small power required for amount of air discharged—And entire absence of friction internally.

MEASURES BROTHERS & Co. Southwark St. London S.E.

Proprietors of Phillips' Patent Rights, and Manufacturers of Patent Girders, Rolled Iron Joists, Channel and Bulb Iron, Rivetted Girders, Flitch Plates, Chequered Plates, Columns, Tanks, Fire-proof Floors, Tee, Angle, Sash Iron, &c., &c.

Have always in their **TOWN STOCK** about **3,000 TONS** of the following sizes, from which orders can be immediately executed at low prices. Section Sheets and Book free on application.

ANGLES.		Manchester Office: 6 BOND STREET.					TEES.	CHANNELS.
8 × 4	3½ × 3½	3 × 3 = 10lbs.	5 × 3 = 13lbs.	7 × 2 = 14lbs.	9½ × 3¾ = 24lbs.	12 × 5 = 42lbs.	5 × 6	12 × 3
6 × 6	3 × 3	3 × 1½ = 5 ,,	5 × 4½ = 23 ,,	7 × 3¾ = 20 ,,	9½ × 4½ = 29 ,,	12 × 6 = 56 ,,	4 × 4½	9¾ × 3½
6 × 3½	2½ × 2½	4 × 1¾ = 7 ,,	6 × 2 = 11 ,,	8 × 4 = 22 ,,	10 × 4½ = 32 ,,	14 × 6 = 60 ,,	5 × 3	9¼ × 2½
5 × 3½	2 × 2	4 × 3 = 12 ,,	6 × 3 = 16 ,,	8 × 5 = 29 ,,	10 × 5 = 36 ,,	16 × 6 = 62 ,,	3 × 3	8 × 2½
4 × 3	1½ × 1½	5 × 2 = 8 ,,	6 × 5 = 29 ,,	8 × 6 = 34 ,,	10 × 6 = 54 ,,	18 × 6¾ = 82 ,,	2½ × 2½	6 × 2½
4 × 4	1 × 1					19½ × 7 = 100 ,,	2 × 2	4½ × 2¾
		JOISTS—Lengths, from 6 to 36 ft. PLATES—Width, 6" to 18"; Length, 12 to 30 ft.; Thickness, ¼" to ¾".					1½ × 1½	2½ × 1
							1 × 1	



WILLIAM SUGG'S
IMPROVED SYSTEM OF STREET LIGHTING,

EXTRACT FROM THE JOURNAL OF GAS LIGHTING, &c., MARCH 16TH, 1880.

Experiments in Improved Street Lighting at Birmingham.

PUBLIC TRIAL, WEDNESDAY, MARCH 10, 1880.

After a prolonged inspection of the various lanterns and burners, tests were made by a shadow meter between Sugg's 200-candle Argand (No. 9), Bray's 200-candle Quadruple Batswing (No. 10), and the Burner and Lantern as used by the Paris Gas Company in the Rue du Quatre Septembre (No. 12), with the results as shown in diagram, Fig. 2. These appear to agree pretty nearly with the photometrical results obtained from each burner, as shown in the preceding table (Mr. Hunt's Experiments, see page 404 of *Journal of Gas Lighting*, March, 1880).

PHOTOMETRICAL TRIALS.

No. 9.
Sugg's 200-Candle Argand Opal Top, Consumption per hour 44 cub. ft.

No. 10.
Bray's 200-Candle. Quadruple Batswing. Consumption per hour 50 cub. ft.

No. 12.
Burner and Lantern used by the Paris Gas Company in the Rue du Quatre Septembre, Consumption per hour, 32 cub. ft.

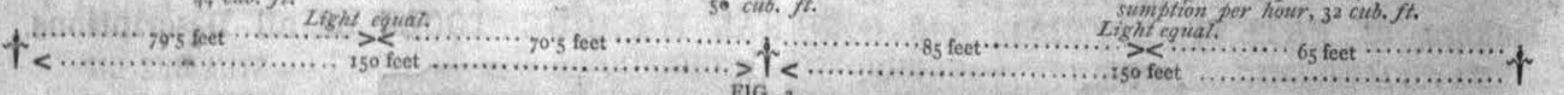


FIG. 2.

NOTE.—The Lights were fixed on Posts in the manner they are used in the Public Streets.

THE RESULTS WORK OUT AS FOLLOWS:—

No. 9.
27 per cent. better than No. 10.
= 191·7 Candles.
Add 24 Candles for the extra 6 ft. of gas required to equal the consumption of No. 10.

No. 10.
= 151 Candles.
or 8 per Cent. better than No. 12.

No 12
= 92·8 Candles.
If the consumption had been 50 ft. the Illuminating power would have been at the same rate—138 Candles.

Total 215·7 Candles or 42 per cent. better than No. 10 for the same quantity of Gas.

The next best on the List is Sugg's 100-candle Argand Burner, as fixed on the Refuges, in the districts of the Phœnix Gas Company, London Gas Company, Commercial Gas and Gas Light and Coke Company. They have been, moreover, definitely adopted by the Vestries of Lambeth, St. George's, St. Mary's, Rotherhithe, Lewisham Board of Works, St. Giles Board of Works, as well as the Great Eastern, Great Northern, London, Brighton and South-Coast and Metropolitan Railways.

The fact that over 1200 of these large Burners and Lanterns have been supplied to almost every Gas Company or Municipal Authorities in England alone, within a very short time, speaks significantly of the excellence of this system and the real merits it has been proved to possess.

Amongst other places the Burners and Lanterns have been adopted, are the following cities:—

PETERBOROUGH
LEEDS
SCARBOROUGH
EASTBOURNE
DURHAM
CHESTERFIELD
CORK
NOTTINGHAM
LEICESTER
STOKE-UPON-TRENT.
RAMSGATE
BLACKBURN
GREENOCK
LIVERPOOL
DONCASTER
LONDONDERRY
SHEFFIELD
BELFAST
OLDHAM
GLASGOW
DUBLIN
HASTINGS
SUNDERLAND
ROCHDALE
SOUTH SHIELDS
IPSWICH
BRIGHTON
COLCHESTER
GREAT GRIMSBY
SWANSEA
CARDIFF
WEST HARTLEPOOL
SOUTHAMPTON
PORTSMOUTH
LEITH
PAISLEY
PERTH
WIGAN
READING
SALFORD
MANCHESTER
BIRMINGHAM

Buenos Ayres, Monte Video, Hong Kong, Singapore, New York, Philadelphia, San Francisco, Milwaukee, Quebec, Ontario, Ottawa, Boston, Sydney, Melbourne, Port Adelaide, Berlin, Vienna, Cologne, The Hague, Amsterdam, Rotterdam, Brussels, &c., &c.

IRON.

LONDON, FRIDAY, APRIL 23, 1880.

THE STORAGE OF ELECTRICITY.

THE subject of electrical generation and application continues to be one of great public interest, and it is probable that we are only yet in the infancy of a widely extended application of electricity to industrial purposes. One point which has not hitherto been practically solved or successfully applied, is the storage of electricity in such a manner that it may be forthcoming in a steady and uniform current on successive occasions after its generation. That this storage is a matter of considerable moment to the useful employment of electricity, more particularly for lighting purposes, is evident, from the fact that storage of gas has to be resorted to in large volume, and at considerable expense for plant and apparatus. Should the idea of large electrical generating centres, distributed over a town for lighting purposes, ever reach the region of accomplished fact, it would be an important consideration in the economical application of such a system, that the electricity generated should be more or less constant, with a reserve to fall back upon in case of emergency. The necessity, also, that the engine-power should be kept running night and day, as long as a single light was required, would evidently be onerous in the extreme, and far from economical. It would seem impossible under ordinary conditions to store up the dynamic electricity generated in the dynamo-electric machines. If we follow on the track of the Leyden jar, we there get the discharge of the accumalated electricity in the shape of a violent shock. It is evident, then, that this principle of the storage of electricity itself in a statical condition cannot be applied in the case in question. If, however, electricity cannot be thus stored, doubtless another form of its energy might be accumulated in such a way as to render it possible to reproduce the electrical current when required. This form of energy may be chemical reaction.

It is known that chemical reaction and electricity are interchangeable forms of energy, we therefore come to an easy solution of the question by proposing to store up the chemical effect of the electrical current, so that it should be able to give the current when the primary exciting cause shall have ceased. For instance, the ordinary Daniel or galvanic battery is composed of two poles, the one usually copper and the other zinc in a solution of sulphate of copper. The galvanic current is produced by the absorption of zinc into the sulphuric acid to form sulphate of zinc, and the deposit of copper upon the copper pole. If now a current of electricity be caused to pass through this battery from the copper to the zinc, that is to say, in the reverse direction to that in which the current is set in motion by the battery, the zinc will be re-deposited on the zinc pole and the copper re-absorbed to re-form the sulphate of copper once more. An exhausted chemical battery is thus brought back to its normal condition of potential electrical energy. By this means if a large series of chemical galvanic batteries be used in connection with a dynamo-electric machine any surplus current, or the whole of it from the machine, might be utilised to bring these chemical batteries into a condition of electrical potential energy. The current from these chemical batteries might then be used for any industrial purposes, such as lighting, in the same way that dynamo-electric current is now used. This reservoir of electrical power might be constantly replenished or renovated by the surplus current of the electric engine, when there was power to spare, and might be depended on to supply a large amount of electrical energy for any special extra requirement, or long after the original electric dynamic engine had ceased to work. This power of storage of a dynamo-electric current, when required, would aid greatly in the successful application of dynamo-electricity to lighting and other purposes.

Exhibition of Helmets and Armour.—The Council of the Royal Archæological Institute of Great Britain and Ireland, under the Presidency of Lord Talbot de Malahide, have arranged to hold an exhibition of English and foreign helmets, coats of mail, &c., at the rooms of the Institute in New Burlington Street, during the week commencing Thursday, June 3rd. Members and their friends, and generally persons interested in such collections, are invited to assist the objects of the exhibition by the loan of old family relics of the above-named description, with notes of any special history or association connected with the object sent for exhibition. The helmets and examples of mail armour will be chronologically classified and carefully labelled. All communications on the subject of this exhibition should be addressed to the secretary, Mr. Albert Hartshorne, at 16, New Burlington Street.

OUR TRADE SUMMARY.

THE iron trade continues in anything but a satisfactory state. The depression which has set in for some time is not only deepening but widening, and as the old contracts are being worked out fresh orders are no longer coming in to supply their place. In the Glasgow warrant market the weakness previously noted has become further intensified, prices are falling and holders eager to get rid of their iron at the reduction, and there is everywhere great despondency with regard to the future. The export trade has almost wholly ceased, and 45s. per ton is openly talked of as being a point likely to be speedily reached. The actual closing prices on Wednesday, were 48s. 7½d. cash, and 48s. 10½d. a month; sellers 1½d. per ton more. The manufactured trade is also falling off, as are also the engineering and shipbuilding industries. Something like a panic is stated to have occurred at Middlesborough on Tuesday, parcels of No. 3 having changed owners at 42s., and the tendency is still downward, although a recovery is generally looked for. Comparative dulness also characterises the finished trade; in some of the large works the men are being discharged owing to lack of orders. There has been great disturbance in the Durham market, traceable, as probably it might be in most other instances, to the fears of speculators. The manufactured trade does not suffer so much as that in pig-iron; but it is still to some extent affected, and prices are weaker. Production goes on as briskly as ever notwithstanding. The action of the Glasgow brokers and the decline of the American demand have also thrown the trade in the Newcastle district into a condition from which it will take some time to recover, but, as in other localities the manufactured trade is but slightly affected, and the Tyne shipbuilders, as well as boilermakers, continue briskly employed. The large copper works are also very active. In the north-west the aspect of matters is somewhat brighter. Very little of the hematite is held by second-hand dealers, and when that has been disposed of makers expect that the downward tendency will be checked, as most of them have sufficient work to occupy them during the current year. Bessemer qualities have been quoted at less than £5 per ton, being a fall of 30s. in three months. The demand for steel is falling off, but the rail mills and merchant mills are fully employed. The Manchester market for the crude material is represented as almost in a prostrate condition, sympathy with the decline in Glasgow and other markets having forced prices down with unexampled rapidity. In other respects matters over the greater part of Lancashire are very much as they are in the other districts. From Yorkshire the news is of similar import—very considerable depression not very equally distributed. In South Yorkshire the Bessemer trade is specially depressed. The armour-plate business is, however, better. The Sheffield local trades appear to be generally more active, but there is difficulty in securing paying rates, owing to the price of steel and other materials. The file trade is especially brisk, as a consequence of which there has been a general rise in wages. In the special industries of Birmingham dulness prevails in sympathy with the state of the iron market there as elsewhere, and there is a want of orders from abroad, while the home trade is flat, with, however, some prospects of improvement at no very distant date. The prices at which many orders have to be taken leaves but little margin for profit. In the Wolverhampton district the kindred industries are described as being in a rather more satisfactory condition. From some parts of the country an improvement in the coal trade is reported generally, however, the long-existing depression continues.

HISTORY OF MODERN INVENTION
IN THE
MANUFACTURE OF IRON.

By W. Mattieu Williams, F.R.A.S., F.C.S.

(*Continued from page* 128.)

The Bessemer Process.—No. 10.

NEXT in order among the specifications describing the development of the Bessemer process is that of the 31st May, 1856—No. 1292—in which Mr. Bessemer states that in carrying into practical effect the process of manufacturing iron and steel by forcing air or steam among the particles of fluid crude iron, he had discovered that certain modifications of and additions to the apparatus and processes described in former specifications may be advantageously used; and that these constitute the present invention, which consists essentially of two parts: (1) a converter with an upper and a lower chamber; in the lower chamber the fluid metal is blown by tuyeres; in the upper, bar ends, ingot ends, or other scrap iron is heated previously to being added to the lower charge of molten crude metal. The second part relates to the casting of ingots and condensing them by hydraulic pressure; also to improving the solidity of iron or steel by casting it under atmospheric pressure, or surrounded by gases that do not support combustion. The converter is shown in vertical sections in fig. 1. Fig. 2 shows a horizontal section, of the upper chamber, *f* (used for heating or melting), through the line, AB; and fig. 3 a horizontal section

Fig. 1.

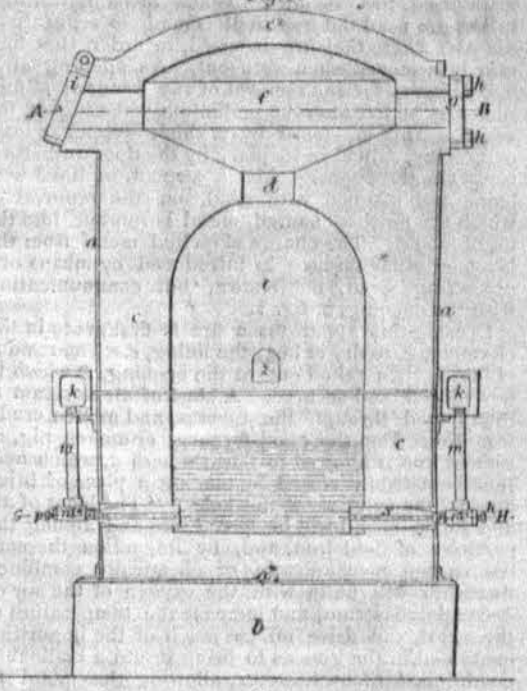


Fig. 2.

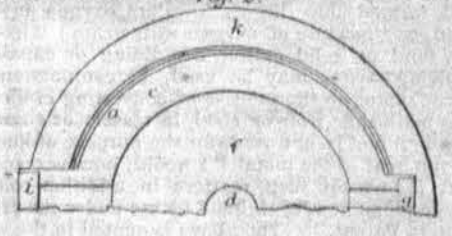
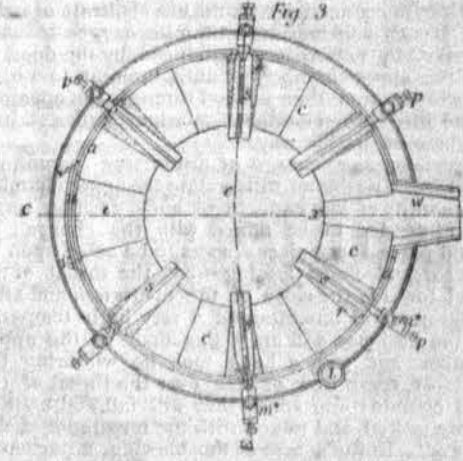


Fig. 3.



of the lower or converting chamber proper, through GH. The outer cylindrical shell, *a a*, is of iron plates riveted to the bottom plate, A², which rests on a brick foundation, *b*. The lining, *c*, is of segmental firebricks or firestone. The upper or heating chamber, *f*, is roofed over with a dome of the lining material, c^2, and has a throat or passage, *d*, communicating with the converting-chamber, *e*. The floor of the heating chamber is shown sloping downwards, in order to facilitate the running of any iron that may be melted, or of any fluid iron that may be thrown up from the converting-chamber by the upward current of flame and gases. Provision may be made, if desirable, to retain such fluid metal in the upper chamber until the lower one is tapped. The chamber, *f*, has an opening on one side for the introduction of ingot ends or other waste or scrap metal. Its door, *g*, is an iron plate to which a fire-tile is fitted, and it turns on the hinges, *h*. On the opposite side is another opening, to which is fitted a damper plate, *i*, hung on horizontal hinges, the mouth of the opening projecting forward more at the lower part than above, so that the damper-plate may lie against it after the manner of a "clack valve," and thus be opened by the pressure of gases from the inside.

The blowing of the melted metal in the lower part of the converting chamber is effected by means of the tuyeres, shown in fig. 3. These are fitted in the lining, *c*, the openings through which are made conical with outward expansion to admit a packing of loam, *r*, around the tuyere pipes, and admit of their removal when worn out. The blast of steam or air is supplied to a channel or pipe, *k*, resting on an angle-iron riveted to the vessel, *a*, and extending entirely around it. The blast is conveyed from this surrounding channel to the tuyeres by suitably-constructed pipes, *m m*.

A small screw plug, *p*, is fitted to one end of the piece, m*, for the purpose of admitting a rod for cleansing or removing obstructions from the tuyeres, In some cases the tuyeres are substituted by perforated segmental bricks of firestone, fireclay, or plumbago, or such mixture of fireclay and plumbago as is used for crucibles. When these perforated bricks are used the iron shell is made to separate at the part where they are inserted, in order that they may be removed when worn out. An opening at *t*, fig. 3, serves for the removal of any remnant of fuel that may be left after the preliminary heating of the vessel. This is closed by a thick stopper of loam or fireclay, *t*, held in its place by the door and strap, *u v*. On the opposite side is a spout, *w*, lined with loam and stopped with sand, on the removal of which the finished melted metal is run out into the ingot mould. The charge of melted metal from the blast or other furnace is introduced by means of a projecting spout, not shown, but communicating with the opening, *z*, fig. 1.

In using this apparatus a fire is first made in the chamber, *e*, to dry or heat the lining, *c*. The residue of fuel is then raked out at the opening, *t*, which is now closed and secured. A blast of air or steam is then forced through the tuyeres, and molten crude iron direct from the blast-furnace, or molten pig, or refined iron is allowed to flow through *z*, which may then be partially closed by placing a piece of brick against the exterior of the hole. "The blast of air and steam mixed will be forced into and among the particles of fluid iron, and, by its action thereon, the carbon mechanically or chemically combined therewith will unite with the oxygen of the air or decomposed steam, and increase the temperature of the metal, and drive off so much of the impurities contained in the iron as to bring it into a malleable condition, without, however, allowing the metal to solidify, and hence the iron or steel so produced may be run off in a fluid state from the taphole, at *x*, and formed into ingots." Pure oxygen may be used, or a mixture of oxygen with steam; "likewise any fluid or solid matter containing or capable of evolving oxygen may be used, in conjunction with air or steam, in the process of converting crude iron into malleable iron or steel, in vessels or chambers in which fuel is not used, for the purpose of keeping up the heat of the metal. I would, however, remark that the use of such matters in addition to air or steam is not new, or claimed by me under the present Letters Patent." (The above is quoted in the words of the specifination, as it bears upon some contested questions in connection with the use of nitrate of soda, &c.) If such solid matters containing oxygen are used they are, by preference, introduced by the door, *g*, into the upper chamber, *f*, until brought to a high temperature, and then pushed through the opening, *d*, into the lower chamber. Various oxides of iron may be used in this way.

"As soon as a charge of crude iron is run into the vessel a workman will put into the upper chamber the quantity of bar ends, ingot ends, or other scrap metal intended to be mixed with the charge; he should place these pieces so as to be acted upon by the heat and flame issuing from the throat of the vessel towards the close of the operation, and after the scrap metal has attained a very high temperature the workman will open the door of the upper chamber, and with a hook tool, he will bring the pieces of scrap iron or steel over the throat of the lower chamber into which they will fall and be then rapidly melted and mixed with the remainder of the charge." In the course of the blowing, a portion of fluid scoria is carried upwards with the gas and flame and expelled from beneath the damper plate, *i*, which serves to prevent the too easy egress of these matters, and thus assists in retaining the high temperature of the contents of the vessel. Should an accumulation of hardened scoria obstruct this, the opening must be cleared by means of a suitable tool. Fluxes, such as "small quantities of lime, silica, or alumina," may be used, also "chloride of sodium, iron scales, oxide of manganese, and other salts or fluxes" may be used to assist in the separation of impurities contained in the crude metal," but their application is not claimed under the present patent. These fluxes may be introduced in the form of powder at the tuyeres, by allowing such powders to fall from a close vessel gradually into the blast pipes, so that they may be blown in and made to act directly upon the fluid metal; or they may be put in at the feeding door and allowed to fall through the opening, *d*, before or during the process. When it is desired to make an alloy of zinc, copper, silver, or other metals with iron or steel, such metals are added in a fluid or solid state, or as salts or oxides, and their mixture is facilitated and maintained by the agitation effected by the blowing. When added in a fluid state they are poured through the opening, *z*, of the converting vessel; when solid they are charged in to the upper chamber through the door, *g*, and left there to acquire a high temperature, after which they are pushed by a rod through the opening, *d*, into the fluid iron or steel. When using salts or oxides of metals for the purpose of producing alloys with the iron or steel, they are introduced by preference in the form of powder at the tuyeres, or put into the vessel previous to running-in the fluid metal. No general claim is made to the production of such alloys.

The second part of this specification describes a mode of casting and compressing ingots of iron or steel. A massive block of iron, somewhat longer than the intended ingot, has an opening of the sectional form of the intended ingot bored or planed through it from end to end. This opening may be parallel, or, by preference, slightly taper. Into its bottom end is fixed a plunger, long enough to rise above the top of the mould. The lower end of this plunger is connected with the ram of a hydraulic press, the mould block being firmly attached to the cylinder of the press. A funnel-shaped ladle, with a hole or spout at the bottom, to which is fitted a movable plug, is fixed above the mould. Through this hole the metal is poured, while still some inches deep above the hole, in order that the fluid slag may not enter the mould. As soon as the metal has solidified, the ram of the press is set in action, and driven upwards to push the ingot out of the mould; or previous to such discharge, the upper mouth of the mould is closed with a strong cover or slide, and the ram of the press working upwards compresses or condenses the metal while still in a semi-fluid state, or as soon as it is solidified. The ingot, when pushed upwards from its mould, is received in a truck running on rails, and passed on to the hammer or rolls while still heated. The ingot mould is kept cool by a water-jacket.

Mr. Bessemer states that he has observed "that at the high temperature necessary to retain malleable iron and steel in a fluid state, that the contact of atmospheric air with the fluid metal produces combustion in the act of casting such metal, and thereby tends to render the metal cellular;" to lessen this defect, the ladle is fitted closely on the top of the mould, and then carbonic acid or other gas or vapour that will not support combustion is forced into or through the mould, so that the metal from the ladle is effectually excluded from atmospheric oxygen during its descent into the mould. A small hole or holes, about the size of a gas-burner, are made in the lower part of the mould, and the gas forced through these by any convenient apparatus, or by the pressure caused by its own generation in a closed vessel. The air is driven out through the pores or joints of the mould, and "the metal will not flow so far into the perforations as to cause any permanent obstruction of them." Mr. Bessemer further states he has "also observed that the cellular condition of steel, and more especially of malleable iron castings, is more or less owing to the spontaneous disengagement of gaseous matter in the interior of the fluid mass," and he accordingly avails himself of the well-known fact that substances capable of evolving gases or vapours do so with greater difficulty if surrounded with a dense atmosphere. To do this the mould is enclosed in a strong cylindrical vessel communicating with a reservoir of compressed gaseous matter, preferably such as will extinguish flame. The metal is rapidly run into the mould through an opening with a slide valve; the valve is then closed, and the communication between the compressed-air reservoir and the strong air-tight case surrounding the mould is opened. The metal is then left to solidify, and the compressed gases let out, after which the mould and its casting may be removed.

PORTABLE TIPPING FURNACE FOR CASTING STEEL AND OTHER METALS.

SINCE the opening of the Paris Exhibition of 1878, when M. Albert Piat's new casting furnace was seen beyond its inventor's foundry, we have, from time to time, kept our readers informed of its improvements and modifications. It will therefore suffice, on the present occasion, to say that this furnace includes a crucible, practically forming part of it, and may be carried by men, run along on rails, or raised by a crane, according to its size, and that it may also be tipped by the same means, so as to pour the metal at the full heat it has acquired. In this way, the last of a series of moulds may be filled with metal of at least the same temperature as the first—possibly a higher temperature, as the same fuel acts upon a smaller quantity; and this, in the case of steel especially, will be admitted by practical founders as no small advantage.

We lately had an opportunity, at M. Piat's works, in the Rue St. Maur, Paris, of seeing some steel run by this furnace. The metal was as hot and liquid as could be desired; and a considerable number of small bevel wheels were cast in succession from the same charge. The furnace used was one mounted on a carriage running on rails, so as to bring it within range of the crane, and capable of containing nearly 2 cwt. But little more than 1 cwt. was, however, charged in, and this was melted with 150 per cent. of coke, the first heat requiring three, and subsequent heats only two hours. The steel used was that known as *acier sans soufflures*, or Terrenoire homogeneous steel, and produced excellent castings, but rather hard, owing to the fact that the metal was melted in a plumbago crucible. By way of showing what could be done with this steel when treated in the crucible-furnace, the runner was knocked off, showing a coarse granular fracture. It was then heated at a smith's forge, and drawn out, under one of M. Piat's atmospheric hammers, to a half-inch square bar. This was hardened and broken, when it presented a fine uniform fracture, like that of a good file. The wheels themselves, though brittle as the runner when cast, are so tough after annealing that the teeth cannot be broken by blows from a hammer; and, it may be added, the two wheels work well together without trimming.

The visitors, among whom was M. Périssé, for a long time associated with M. Ponsard, then adjourned to the works of MM. Lehmann Frères, nickel, brass and gun-metal founders, where, under the supervision of M. Piat as regards the furnace, and M. Guillemin for the casting, they saw 350 kilogrammes (nearly 7 cwt.) of phosphor bronze melted, with very little coke, in less than an hour, to cast a roll of 300 kilog. (nearly 6 cwt.) for printing on indiarubber. While the metal was being heated, there was ample opportunity for contrasting the new system with the old. A brickwork bank of ordinary brass-furnaces was heated by the blast below, the products of combustion finding their way out by the hole in the top and up a single large chimney; and the pots of molten metal were drawn out by tongs, and carried to the moulds, with great loss of heat owing to the atmosphere, and of metal through spilling, though fortunately no crucible broke in its journey, as often happens. The crucible furnace, on the contrary, containing its own coke, rested on its seat provided with a grating whence issued the blast, which, after intensifying the fire surrounding the crucible, passed into a reheater at the back, as will be described below, and then up the chimney. No injurious fumes from the copper came out into the foundry, to the danger of the workmen charging-in the metal and attending to the fire. When the charge was melted and the blast turned off, the furnace with its crucible inside was picked up by a crane, swung round over the mould, and tipped gradually and uniformly, so as to waste not a drop of metal, the boiling of which in the runner-hole, for a long time after the pour, showed how unnecessary it was to use rods for keeping it liquid in the usual manner. When this furnace is not in use for ordinary casting, it serves to melt the dross, and this without blast.

We saw at the works a 20-kilog. furnace, just finished for melting gold at the Paris Mint, one of 120-kilog. capacity having been supplied a short time previously. M. Piat has also fitted up recently what may be termed a model foundry, for M. Edouard Bourdon, Paris, the well-known manufacturer of pressure and vacuum gauges, who has carefully noted the particulars of time passed and fuel consumed. The furnaces are each capable of melting 35-kilog. (nearly ¾-cwt.), heated with foundry coke. With two men, one at the furnace and one at the travelling crane, six pours of yellow brass were made in 3½-hours; that is, an average of 35 min. each The charge was 30-kilog. (over ½-cwt.); and the castings were small, chiefly gauge cases weighing about 2 lb. The consumption of coke was, on an average, 6·4 kilog. for each pair of 30 kilog., or 22 per cent. of the substances consumed, 24 per cent. of the metal melted and 48 per cent. of the castings produced. The travelling crane at M. Bourdon's foundry, specially designed by M. Piat, with the three chains for lifting, travelling and moving in a transverse direction, are all brought together at one end, so that one man may operate them and be out of the way of the founder, though able to watch his movements.

Details of the furnaces, though of a larger size, are given, in vertical longitudinal section at fig. 1, horizontal section at fig. 2, and front view at fig. 3 while fig. 4 shows a vertical section through the reheater. The furnace proper is a rectangular box of sheet iron, surrounded by a strap carrying the trunnions, and lined with firebricks and fireclay, A. B is the crucible, supported on a cylindrical fireclay stand, and pressed up against the spout by the wedge at back. The whole furnace rests on a hollow bed, D, whence it is lifted off by the crane, a butt joint being also formed with the flue, H. E is a movable cover for closing in the ash-pit and permitting the withdrawal of the dross. The blast is admitted by the damper, G, into the ash-pit, when it ascends through the grating, and intensifies the coke-fire between the crucible and the fireclay lining. It then passes into the flue, H, thence into the chamber, I, and out, by the flue, K, into the chimney. The metal for the succeeding charge is placed upon the grating, J, to be heated by the waste gases, so as to be more readily melted when charged into the furnace. The tops of the furnace and of the reheater are closed in with fireclay slabs, C and C^1. The trunnions have square ends for facilitating the tipping, as shown in figs. 2 and 3; in fact, both in this respect and generally, the furnace resembles a foundry ladle, though rectangular instead of cylindrical.

Fig. 5 shows a vertical longitudinal section, and fig. 6 a horizontal section, of a somewhat similar furnace to the above, for melting 6 cwt. of metal, but fitted with a regenerator for heating the blast, instead of a reheater for the charge. As the crucible is not shown in the horizontal section, the means by which it is supported are perfectly clear; the dotted lines, in the vertical section, outside the crucible indicate the largest size that may be used. The furnace bears on its seat by the angle-iron frame at L, L; and the butt joint formed with the heat regenerator is at M, M. The heated gases pass, in the direction of the full arrows, down the series of square tubes, cast in two pieces, and thence

PORTABLE TIPPING FURNACE FOR CASTING STEEL, &c.

BY M. ALBERT PIAT, OF PARIS.

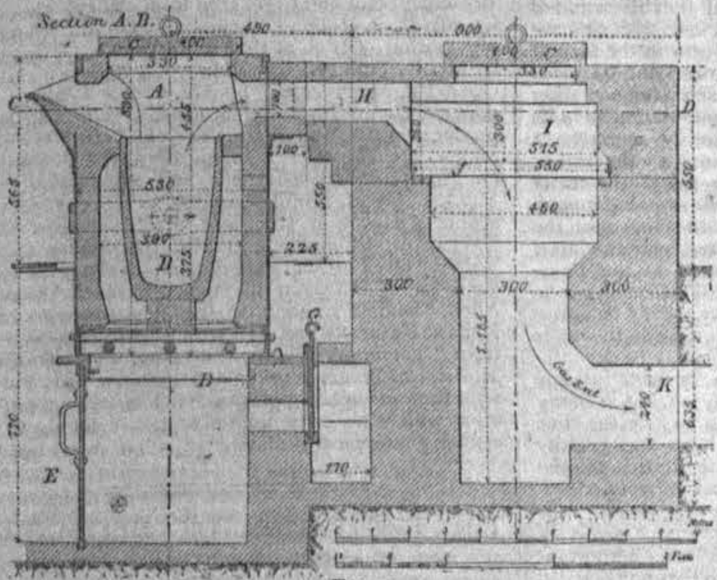


FIG. 1.

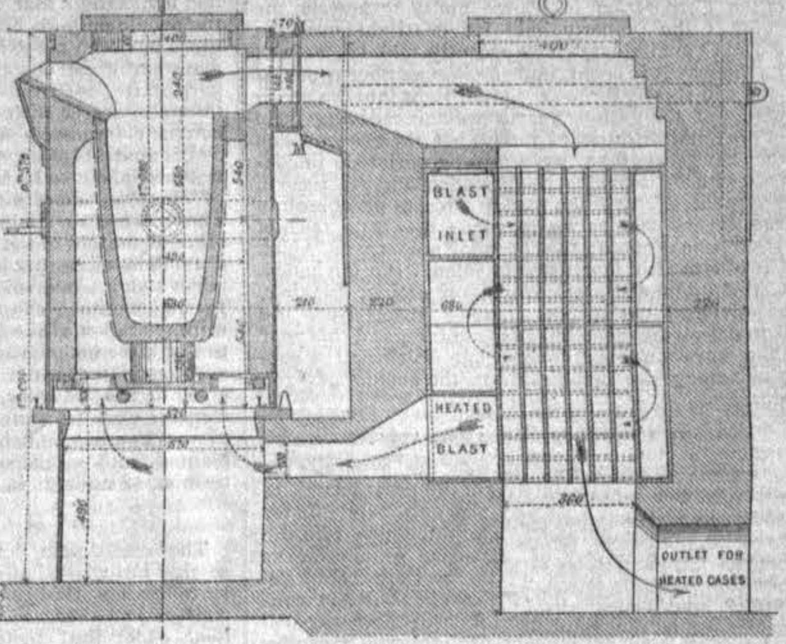


FIG. 5.

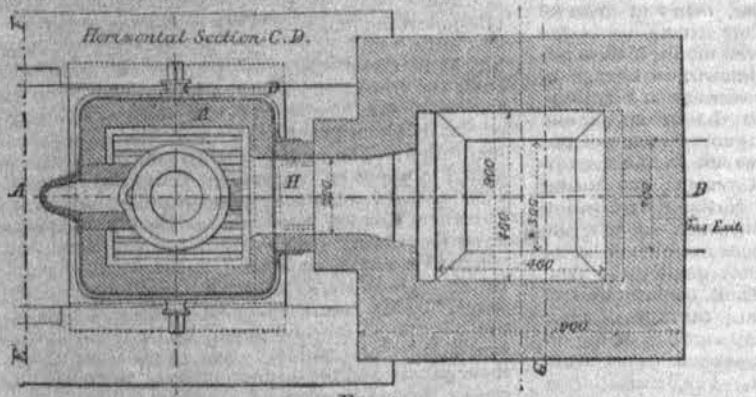


FIG. 2.

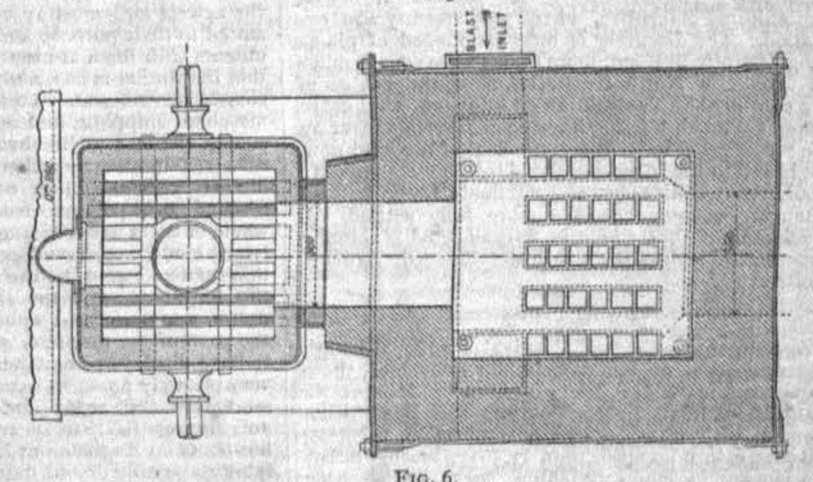


FIG. 6.

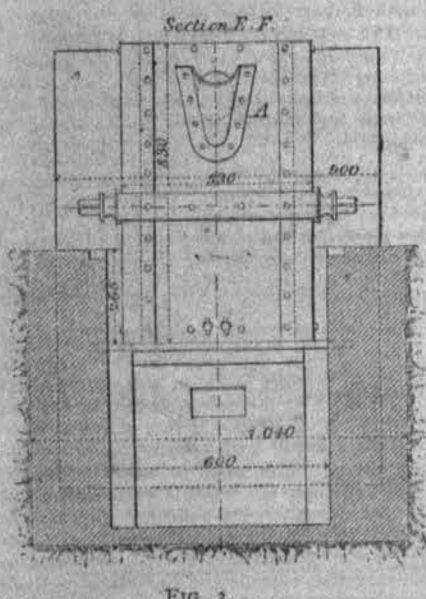


FIG. 3.

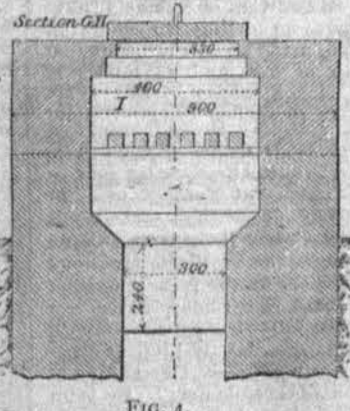


FIG. 4.

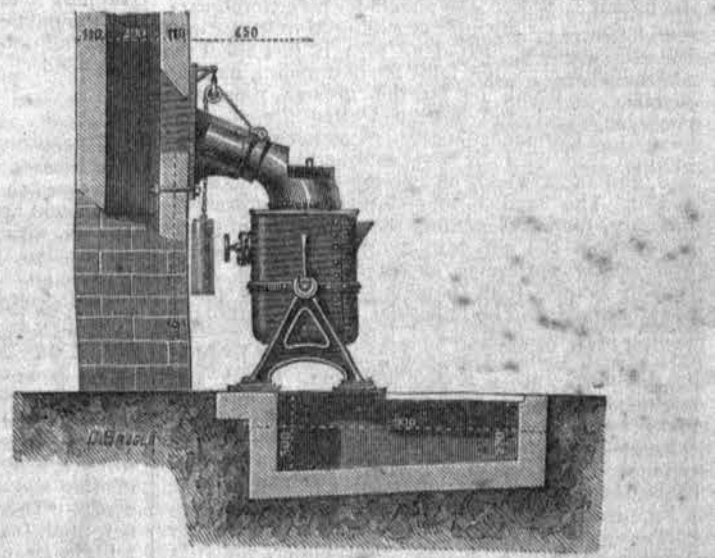


FIG. 7.

out into the chimney; while the blast, admitted, as shown in fig. 6, passes round outside these tubes in the direction of the dotted arrows, before finding its way to the furnace. In this manner, an exceedingly hot fire is obtained, especially suitable for melting large charges of steel. For ordinary purposes, indeed, the arrangement has been found to give more intense heat than is necessary. A combination of two furnaces, set side by side, has therefore been devised, in which the waste gases from the furnace in blast serve to heat the succeeding charge contained in the other crucible; and, when the first charge is run, and the crucible re-charged, the blast is reversed, so that the waste gases from No. 2 may give a preliminary heating to the charge in No. 1.

Fig. 7 shows the arrangement of furnace for a natural draught, merely put in communication with any chimney. The hood over the top is provided with a cover for charging-in and skimming the metal; but when the furnace has to be removed or tipped for pouring, this hood, which is counterbalanced, is turned up, leaving the furnace perfectly clear. The hand wheel and screw shown at the back is for pressing the crucible close up against the spout by means of the fireclay wedge; but the screw is now dispensed with. This arrangement of furnace is also made to run on rails, and is provided, in some cases, with a winch for tipping.

These crucible furnaces are found very convenient in every size; but there are two cases in which they appear almost indispensable, especially for steel castings: when the crucible contains only about ½ cwt., and can be handled by two men; or with a capacity of from 2 to 4 cwt., worked by a crane, for large castings and melting the dross economically. In the event of crucible furnaces intended for brass or gunmetal being used for casting steel, the capacity of the crucible should be about 20 per cent. less. A portable tipping furnace, 150 lb. capacity, has, for some time past, been in use at Glasgow, by Messrs. Mirrlees, Tait and Watson, who have lately communicated the results of a series of experiments while mixing new metal. The data show a yield of 158 lb. per hour, with 28 lb. of coke; or, in other words, 100 lb. of metal cast every 38 minutes, with 18 per cent. of coke. We may add that the office of M. Piat's concessionnaire for England is at 7, Westminster Chambers, S.W.

PUT TO A NEW USE.—A model fireplace, with fender, fireirons, &c., complete, has just been presented to the Natal Society's Museum by Mr. J. C. Wilson. The model, a perfect work of art, is entirely made from bullets fired at the British troops by the Zulus at Ulundi, and was constructed by a 60th Rifleman, who was present at that battle.

OCCASIONAL NOTES.

A LESSON FOR THE CITY.

THE income of the Corporation of London, its companies and charities, has risen to its present amount, as every one knows, not from any skilful management but almost wholly owing to the unearned increment of the land rents of the City. The income of the Corporation is known pretty accurately, the value of the property held for charitable uses the Royal Commissioners have recently told us, as well as the way it is spent, and possibly another commission will shortly throw a similar light into the secret places of the guilds, preparatory to relieving them of the administration of wealth not their own which they have so for many years misappropriated. In contrast with the municipal peculation so long practised in the greatest city in the world, a recent paragraph in the papers enables us to place the little town of Haltern in Prussia, the burghal property of which has of late also increased in value. But the honest German administrators, instead of eating, drinking, or dividing the income among themselves, use it to defray the communal expenditure, and this year they have not only done so but distributed a surplus among the inhabitants to the amount of £700 sterling.

THE INTERIOR OF AUSTRALIA.

It is not very long since it was the generally received opinion that the interior of the great island, or rather continent, of Australia, was only habitable for a certain and comparatively short distance from the coast. The discovery of extensive grassy downs and of good-sized rivers on the western borders of New South Wales put this hypothetical desert considerably farther back, where, indeed, there was still room for it; but subsequent explorations have disclosed large tracts suitable for pastoral if not for agricultural enterprise, where only sterility was expected. The discovery is now announced of plains magnificently grassed, more than 30,000 square miles in extent, in North Australia, near the centre of the continent. The soil is rich alluvium, and other tracts not much inferior have been travelled over by the surveyors. Indeed, a good deal of the land now neglected in the neighbourhood of the settlements would repay cultivation, and will doubtless be utilised when the country becomes more fully settled. A good deal of that which is thus slighted is actually superior to much of the soil in the Eastern States of North America.

EMIGRATION.

Accompanying the partial revival of trade, although the connection of the facts is not so evident, there has been a marked, indeed an excessive, increase in emigration from Europe during the past three months, with no sign of any diminution. During the past month no fewer than 13,363 passengers left the Mersey in emigrant ships, 5053 English, 2287 Irish, and 82 Scotch, the remainder being foreigners. The increase for the quarter ending March 31st over the corresponding period of 1879 is just about the same number as the total for that month, namely, 13,437. As usual, by far the greater proportion (12,617) were bound for the United States. One batch of Germans, nearly 2000 strong, passed through Hull on their way to America a few days ago, and another body of 3000 are expected in a day or two. The exodus from Germany is most extraordinary, more resembling those transfers of population from the *officina gentium* which used to exercise the statesmen and generals of the early Roman Empire, than anything that has happened in recent times. The industrial depression through which Europe has passed of late must have pressed very heavily upon the Germans, borne down, besides, by the conscription and other evils, social and political; but it is somewhat remarkable that the flight has not taken place at an earlier period. Besides those who have left from English ports in the first week of the present month nearly 6006 emigrants sailed west from Bremen, and between the 1st of January and the 11th of April 14,000 were despatched from that port—more than double the number that sailed the previous summer, which is naturally the season most chosen for the voyage. If we are to judge by this of the prospects of emigration from Germany in the coming summer, it will be something unexampled. Besides Germans, some 3000 Swedes have also made their way in the present year, from Bremen to the States.

RAILWAY PARAPETS.

In reporting to the Board of Trade upon the fatal accident which happened a short time ago by a portion of a North British mineral train running off the rails and falling into the river Calder from a great height, Major Marindin suggests that a little stronger parapet might have prevented the tragical occurrence. No parapet, of course, could be built to withstand the impact of a locomotive or loaded truck; but Major Marindin shows that in this instance even a low and weak parapet had at first the effect of diverting the course of the vehicles, and he thinks that one somewhat stronger might have kept them on the line and averted the fatal fall into the bed of the river. A very slight obstacle will turn a vehicle striking it obliquely, and Major Marindin therefore holds that no high viaducts ought to be constructed without good parapets as a protection in case of a run-off.

PROGRESS IN SOUTHERN ITALY.

There are a good many discomforts and not a few dangers connected with a residence in more than one Italian district; but the great advance in order and civilisation that has followed the liberation of the people ought not to be overlooked. Much progress has been made in many respects in the face of many and great obstacles, which need not be more particularly referred to here; and among other things of lesser moment that may be taken as indications of improvements less obviously apparent, a correspondent of *The Times* points to the rail or tramway about to be opened to the top of the crater of Vesuvius, and within 800 feet of its smoking funnel. There are two stations, one at the top and the other at the foot of the mountain, and near the latter a small hotel, with a buffet decorated in the Pompeian style. And, what would make a Roman of the period open his eyes to their widest, there is now a railway station at the Pompeii, and outside the walls two or three hotels where the visitor may be decently accommodated, while the Silent City itself is freely open to the traveller, and not only so, but in many respects very different from what it was in the time of the Bourbons, being neatly kept and prettily planted, with a museum and an institution for the training of students in archæological pursuits.

THE LIFE-BOAT SERVICE.

The remarkable development of this important service during the half-century or so that has elapsed since the first life-boat was launched on the British coast is well shown in the annual report of the National Life-Boat Institution just published. The number of well-appointed boats, many of them of the newest and most approved construction—so well suited to their purpose and so well manned that accidents with them are scarcely known, in charge of this Institution is 269, and they seem to be very judiciously distributed. Owing to the extent of our merchant shipping, and the dangerous nature of our coasts, the loss of life by shipwreck in the narrow seas reaches nearly a thousand yearly; but during the last year the boats of the National Institution rescued 636 persons from shipwreck—nearly the whole of them under circumstances in which ordinary boats could not have been safely employed. And this service, owing to the excellent construction of the life-boats, and the skill and courage of their crews, was performed without any sacrifice of life on the part of the rescuers, who in several cases seem to have displayed great heroism. The Institution is very properly doing its utmost to replace old boats with others on newer and more approved models, and during the past year has placed twelve new life-boats on English and Irish stations. It is gratifying to be able to add that the calls for pecuniary support to this good work are liberally responded to by the public, and that the sphere of operations of the Institution is thereby likely to be still further extended.

Compound Armour Plates.—We are informed that Messrs. John Brown and Co., of Sheffield, have forwarded to Shoeburyness for testing the following compound armour plates, made on Mr. Ellis's patent system, with 10½ inches of iron and 5½ inches of steel—viz., 1 plate for H.M.S. *Ajax*, 7 feet deep, 7 feet 4 inches long, and 16 inches thick; 1 plate for experiment, 7 feet 2 inches deep, 7 feet 3 inches wide, and 16 inches thick, both bent to a radius of 12 feet 7 inches inside, and weighing 14 tons each.

The Institution of Civil Engineers.—We are requested to state that the final series of Meetings of the Students of this Society for the present session will be held on the undermentioned dates, for reading and discussing the following papers:—April 23rd.—"Dredging Appliances." By Lindsay Burnet, Stud. Inst. C.E. April 30th.—"Description of a Light Draught Steel Paddle Steamer." By John Augustus Thompson, Stud. Inst. C.E.; and May 7th "Calais Harbour Improvements." By Hans Ditler Fabricius, Stud. Inst. C.E. The chair will be taken at 7 o'clock each evening and in rotation by Sir John Coode, Mr. Cowper and Mr. Abernethy, V.P., Members of Council. The Council have accepted, on behalf of the Students, an invitation from Mr. George Livesey, M. Inst, C.E., to inspect the South Metropolitan Gas Company's Works, 589, Old Kent Road, London, S.E., where a concrete gas-holder tank is now being constructed.

The Iron and Steel Institute.—As briefly stated by us recently, the Annual General Meeting of the Iron and Steel Institute will take place on Wednesday, the 5th, and two following days, of May next, in the Hall of the Institute of Civil Engineers, Westminster, by the kind permission of the President and Council of that body. It is gratifying to find that upon that occasion the Bessemer Medal for 1880 will be presented to Sir Joseph Whitworth. After the presentation and after the transaction of the ordinary routine business, the adjourned discussion on a paper, "On Hardening Steel: its causes and effects," by Professor Richard Akerman, of Stockholm, will take place. The following is a list of the papers set down for reading:—"On some Physical changes occurring in Iron and Steel at High Temperatures" (Supplementary Paper), by Mr. Thomas Wrightson, Stockton; "On the Manufacture of Bessemer Steel and Ingot Iron from Phosphoric Pig," by Mr. C. B. Holland, Sheffield; "On the Dephosphorisation of Iron at the Hörde Works, Germany," by Mr. R. Pink, Westphalia; "On Reactions in the Open-Hearth Process," by Mr. Arthur Willis, Landore; "On an Improved Method of Utilising Byeproducts in the Manufacture of Coke," by Mr. Henry Simon, Manchester; "On an Improved Apparatus for Analysing Blast-furnace and other Gases," by Mr. J. E. Stead, Middlesborough; "On the Spectroscopic Analysis of Iron and Steel," by Mr. Alex. E. Tucker, Rhymney, and Mr. John Parry, Ebbw Vale; "On Further Experiments to determine the Presence of Nitrogen in Steel," by Mr. Alfred H. Allen, Sheffield; and "On the Resistance of Steel Rails at Naturally and Artificially Lowered Temperatures," communicated by the Hon. D. Jowraffsky, Minister of Public Works, St. Petersburg. It will be seen that an excellent programme has been prepared, from which we may augur that a meeting of no ordinary interest will result.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE members of the Institution of Mechanical Engineers have again met, and are holding their ordinary general meeting in the hall of the Institution of Civil Engineers, in Westminster, by permission of the council of that professional body. The first sitting took place last evening, the president, Mr. E. A. Cowper, occupying the chair, and the first business transacted was of a formal character, consisting of the election of new members and associates, of whom twenty-three were thus added to the Institution. The routine business having been completed, a paper on Permanent Ways for Tramways, with special reference to steam-traction, by Mr. J. D. Larsen, of London, was read. The other papers set down for reading at this meeting are "Remarks on Chernoff's paper, on Steel," by Mr. W. Anderson, o Erith. "On Water-Pressure Engines for Mining Purposes," by Mr. Henry Davey, of Leeds, and "On Electric Lighting," (second paper) by Dr. John Hopkinson, F.R.S., of London. We reserve our report of these papers and the discussions upon them until next week. It was announced that the autumn meeting of the Institution would be held at Barrow-in-Furness in the first week in August.

FORM OF RIVETED JOINTS.*

(*Continued from page 224.*)

FRICTION *of Riveted Plates.*—Mr. Clark made some experiments to determine the friction of plates riveted together, the pressure between the plates being due to the contraction of the rivet in cooling. These experiments gave for the friction, estimated per square inch of rivet section:—

4·66, 3·72, 6·61, 7·88 tons.
Mean 5·72 tons.

Researches on friction and shearing made by Harkort, are given in Von Kaven's Collectaneen. The specimens were prepared in the form shown in the annexed fig. 7. Specimens with the rivet in double shear (fig. 7) were riveted hot. Specimens (fig. 7a) had a pin driven in, so that there should

Fig. 5.

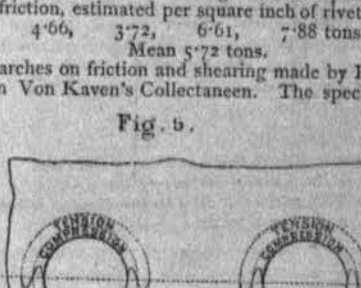


Fig. 6.

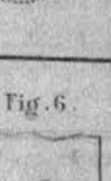


Fig. 6a.

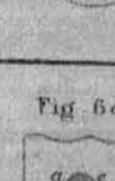


Fig. 7

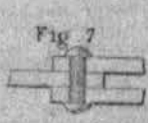


Fig. 7a

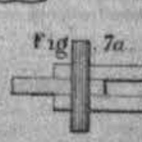
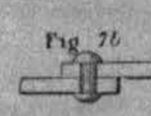


Fig. 7b



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* Reports to Research Committees of the Institution of Mechanical Engineers.

be no friction due to the contraction of the rivet. Lastly, specimens (fig. 7*b*) were riveted hot with the rivet in single shear. Calling f_s the shearing resistance and f_f the friction between the plates for each rivet, then the tension required to break the joint would be,

In case A. $T_a = 2f_s + 2f_f$
„ B. $T_b = 2f_s$
„ C. $T_c = f_s + f_f$

$$\text{Hence } f_f = \frac{T_a - T_b}{2} = T_c - \frac{T_b}{2}$$

$$f_s = \frac{T_a}{2} - f_f = \frac{T_b}{2} = T_c - f_f$$

Reducing results with ⅝-inch rivets, the friction was found to amount to 4·65 tons per square inch of riveted area, and the shearing resistance of the rivets was 16·5 tons per square inch. The absolute tenacity of the rivet iron was 26·4 tons per square inch. Hence the shearing resistance was little more than six 10ths of the tenacity. Lavelley made experiments for Gouin and Co., and found the shearing resistance of bars fixed in a steel fork to be 20·2 tons per square inch, with iron having a tenacity of 25·4 tons per square inch. Six experiments to determine the friction gave a mean of 10 tons per square inch.

If this friction subsisted unimpaired till the fracture of the joint, the apparent shearing resistance would be increased by the whole amount here given. But as to produce this amount of friction the rivet must be strained beyond its elastic limit, the tension of the rivet probably relaxes a little in course of time. When the tension in the rivet does not exceed its elastic resistance, the friction probably may amount to 3 or 3½ tons per square inch of rivet section. In the approach towards fracture even this amount of friction is probably almost or quite destroyed.

In some experiments by Mr. Parker it appeared that with lap joints there is a sensible separation of the plates at the edge of the overlap with one-eighth of the ultimate breaking weight. Mr. Parker infers that the plates slip and separate so much before fracture that, in these joints, the friction is destroyed before the breaking point is reached. The looseness of the rivets in the holes of some trebled-riveted lap joints broken by tension, which are in Mr. Parker's possession, is very remarkable.

In Messrs. Greig and Eyth's experiments three strips were connected by a rivet so that the rivet was in double shear. The riveting was done by different machines, and then the rivet was broken by shearing. It appeared that the shearing resistance was highest with joints riveted by the machines which worked with the greatest pressure. With steel rivets ⅝-inch in diameter in 11-16 inch drilled holes the pressure on the rivet when riveting and the breaking stress were as follows:—

	Pressure on Rivet in tons.		Shearing Resistance. of two Rivets.
Steam riveter	37	..	19·07
Stationary hydraulic riveter	39	..	17·63
Portable hydraulic riveter..	20	..	16·88
Power riveter, light	31	..	16·67
„ „ heavy	52	..	17·60

The results are not very accordant. If there is a real difference in the shearing resistance with different riveting pressures, it must be due to friction, or to some change in the strength of the material in the process of riveting. The difficulty in ascribing it to the former cause is this, that it is not probable that a red-hot rivet can retain the compression it receives from the riveting machine. It has hitherto generally been assumed that the clipping together of the plates which produces friction is due to the contraction of the rivet in cooling, and not to pressure put upon it by the riveting machine.

Mr. Kirk has recently shown to the Reporter some joints cut through after riveting. These appear to show that in thick plates a tighter joint is obtained by continuing the riveting pressure for a sensible period, instead of removing it at once as in ordinary machine riveting. The point is not quite clearly made out, but it deserves further investigation.

It does not seem at all impossible that thick plates may spring a little, while the rivet is still red hot, and it would be very objectionable if this were really the case.

Pressure on the bearing surface of the Rivet.—If P is the tension on a joint corresponding to one rivet, d the diameter of the rivet, and t the thickness of the plate, then

$$f_c = \frac{P}{dt}$$

may be defined as the mean crushing pressure of the rivet on the plate. Putting f_s for the shearing resistance of the rivet, then, the rivets being in single shear,

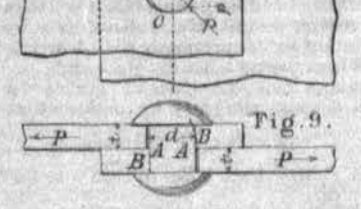
$$f_c dt = f_s \frac{\pi}{4} d^2 = P$$

$$\frac{f_c}{f_s} = \cdot 785 \frac{d}{t}$$

or the crushing pressure is greater as the ratio of the rivet diameter to the thickness of plates is greater. This is sometimes given as the reason why the rivet diameter should not exceed 2½ to 3 times the plate thickness. It is by some writers asserted, that if in any case f_c is more than 30 or 40 tons per square inch for iron joints, then the joint gives way with a very low apparent tenacity. During the application of the load the rivet-hole becomes oval, the metal of the plate is crushed and its tenacity diminished. The precise way in which the crushing affects the tenacity has not hitherto been indicated; but it is suggested above that it produces an unequal distribution of the stress similar to that induced by punching. There are no direct experiments on the crushing of iron and steel, which are of any value in determining the proper limits of crushing pressure for riveted joints. But it will be convenient to discuss here some results obtained with actual joints which have a bearing on this question.

To the Reporter it appears that there is no assignable value of f_c at which crushing action occurs. From the very irregular distribution of the pressure on the surface of the rivet it is probable that the maximum pressure of the rivet on the plate is much greater than its mean value f_c. Then for moderate values of f_c (25 to 30 tons per square inch for instance) the maximum pressure might be 50 or 60 tons, and under that pressure some crushing would almost certainly occur. Some experiments seem to show that while there is deterioration of the tenacity, even with ordinary values of f_c, that deterioration increases as f_c increases, and is very serious indeed if f_c amounts to 40 or 45 tons per square inch, that is in the case of iron plates. For steel plates no experiments hitherto made show any great diminution of tenacity attributable to crushing action, although in some experiments the value of f_c reaches to 40 to 50 tons per square inch.

Fig. 8.



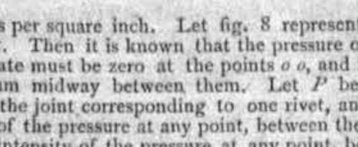


Fig. 9.

Let fig. 8 represent an ordinary joint. Then it is known that the pressure of the rivet on the plate must be zero at the points *o o*, and increase to a maximum midway between them. Let P be the total stress on the joint corresponding to one rivet, and p be the intensity of the pressure at any point, between the rivet and p be the intensity of the pressure at any point, between the rivet and plate, normal to the surfaces in contact. Let $t \frac{d}{2} \delta a$ be an element of surface of the rivet subtended by the angle δa in the neighbourhood of that point. Then the whole pressure on that element of surface is $p\, t \frac{d}{2} \delta a$, and its component in the direction of the load on the joint is $p\, t \frac{d}{2} \delta a \cos a$. Hence

$$P = t\, d \int_0^{\frac{\pi}{2}} p \cos a\, \delta a$$

Assume that* $p = p_{max} \cos a$

$$\text{then} \qquad P = t\, d\, p_{max} \int_0^{\frac{\pi}{2}} \cos^2 a\, da$$

$$= p_{max}\, d\, t \frac{\pi}{4}$$

$$\text{But} \qquad P = f_c\, d\, t$$

$$\text{Hence} \qquad p_{max} = 1{\cdot}27 f_c.$$

Or the maximum crushing pressure is 1·27 times the mean crushing pressure. But it is also extremely probable that, in a plane at right angles to that thus far considered, there is also a variation of pressure. The pressure at the points AA, fig. 9, must be greater than that at BB, and if this variation were taken into consideration, we should get a much higher value for the ratio $\frac{p_{max}}{f_c}$. In a rivet in double shear this second variation of distribution of crushing pressure is absent to a great extent, and probably that is the reason why a higher limit of crushing pressure seems from the experiments to be permissible with joints having two cover plates.

(To be continued.)

STEAM BOILER EXPLOSIONS.

The committal for trial on Friday last of the engineer in charge of the boilers at the Glasgow Ironworks for culpable homicide in connection with the recent disastrous explosion at those works, by which twenty-five persons have been killed, and a number of others seriously injured, will no doubt again direct public attention to the much-debated question of compulsory inspection of steam boilers. The following paper upon this subject, which we reprint from the Report of the Chief Engineer of the Boiler Insurance and Steam Power Company, referred to in our issue of the 9th inst., will be read with special interest at the present time. It is a matter for regret that the circulation of this report is limited to the clients of the company, as in the hands of the present chief engineer, Mr. McDougall, the report promises to become an engineering annual of considerable interest to steam users generally.

Compulsory Inspection of Steam Boilers.

The attention of Parliament has again been called during the past session to the loss of life occasioned by the explosion of boilers, and Government interference has been sought to enforce independent inspection of all steam boilers.

The following motion was put before the House of Commons by Mr. Burt, the member for Morpeth, on the 29th April last:—

"That, in the opinion of this House, it is desirable that enginemen should undergo an examination as to their fitness before they are placed in charge of engines and boilers; and that it is incumbent on steam users to provide for a competent and an independent inspection of all steam boilers, and to report to the Board of Trade or the Home Office."

After some discussion the motion was withdrawn at the instance of the Home Secretary, who, while admitting the benefit to be derived from independent inspection, did not consider that a case for Government intervention had been made out. He proposed only to follow the course already adopted by the Government, viz., that of deputing some engineer to represent the Home Office at the inquest following any explosion attended by loss of life. In withdrawing the motion, Mr. Burt stated that he "could not profess to be altogether satisfied with the answer he had received, but acting on the advice of his friends, and on what seemed to be the general view of the House, he begged to withdraw the motion, reserving to himself the right to watch the subject, and to bring it forward in a less objectionable shape."

Judging from the reception given to this motion, it appears to be evident that Parliament is now as little as ever disposed to legislate in the matter. As, however, agitation is still kept up with the object of obtaining Government interference, it may be well to recapitulate here the principal conclusions arrived at by the Parliamentary Committee, which, after a long and exhaustive examination, reported upon the subject in 1871. This committee, after having examined some forty witnesses, including some of the most eminent engineers of the day, reported that they were not prepared to recommend the adoption of any system founded upon the theory of compulsory periodical inspection, the evidence they had taken having appeared to show:—

(1) That the explosions at present number about 50 per annum, or at most, one explosion in 2000 boilers.*

(2) That a great number of these explosions arise from causes independent of and apart from anything that could be prevented by periodical inspection.

(3) That it is doubtful whether compulsory inspection would not lessen the responsibility of the users, who are best able to ascertain the condition of their boilers, and the competency of the men employed to work them.

In view of these considerations the committee made the following recommendations:—

(1) That it be distinctly laid down by statute that the steam user is responsible for the efficiency of his boilers and machinery, and for employing competent men to work them.

(2) That in the event of explosion, the onus of proof of efficiency should rest on the steam user.

(3) That in order to raise *prima facie* proof, it shall be sufficient to show that the boiler was at the time of the explosion under the management of the owner or user, or his servant; and such *prima facie* proof shall only be rebutted by proof that the accident arose from some cause beyond the control of such owner or user; and that it shall be no defence in an action by a servant against such owner or user, being his master, that the damage arose from the negligence of a fellow-servant.

(4) That whenever an explosion happens to a boiler, whether such explosion is or is not attended with loss of life, or injury to person, or damage to property, it shall be the duty of the user to report the same to the coroner of the district; and the coroner to whom the accident is reported—or in failure of such report, on the fact coming to his knowledge—shall hold an inquiry, and apply to the Board of Trade, and the Board of Trade shall thereupon direct one of their competent practical surveyors of boilers, or some other practical person, to assist the coroner in the investigation.

(5) That the coroner shall report the result of each investigation to the Secretary of State for the Home Department, and that such reports be annually presented to Parliament.

The recommendation that assistance should be given to coroners by engineer officers of the Board of Trade has been acted upon to some extent in the case of fatal explosions, but beyond this, the proposals of the committee have not taken effect. A Bill embodying the recommendations was brought before the House of Commons in 1872, but was thrown out without discussion.

From the verdicts given by juries in various parts of the country in the case of fatal boiler explosions, the opinion appears to be very generally held that compulsory inspection involving direct control and inspection of all boilers by Government officers would lead to good results. Taking the example of Germany into consideration, the introduction of such a system, although it would be attended by much greater difficulties in this country from the enormous extent to which steam is used, might perhaps be found practicable, but judging from German experience, the results which might be expected would be wholly inadequate to the cost involved. A German engineer, Mr. Kirchner, of Berlin, has carefully investigated the matter in a recent pamphlet, from which it appears that in Germany the number of explosions from 1870 to 1876 averaged 13·1 per annum. Comparing this result with that obtained in Great Britain, without Government supervision of any kind, Mr. Kirchner remarks—"Therefore the proportion of explosions in England to those in Prussia equals 14·4 to 13·1, or we have in Prussia 1·3 explosions or an average less than in England.† This is no encouraging result if we consider the necessary expense to which the State is put, viz., 26,000 boilers at 14s. 3½d. per boiler cost £18,564, and to prevent one explosion, it has cost the State £14,280."

A translation of the German boiler laws will be found further on, and from these it will be seen that a complete or thorough examination of the boiler inside and outside is only insisted upon every six years, and an external examination every two years. Other examinations are required, as when any irregularity has been discovered in the working of the boiler an additional inspection may be ordered, and the application of the test by water pressure after repairs of any extent is also insisted upon. But it may still be objected to the German system that the examinations are not sufficiently frequent, and that the number of explosions is therefore higher than it would be if more frequent examinations by the State officials were made. This, however, would of course lead to an increase in cost, and taking also into consideration the fact that the Government official work in this country would cost more than on the Continent, it will be evident that to carry out the system effectively in England, the prevention of each explosion would cost far more than indicated above. Having regard to the question of cost alone, it appears therefore that direct Government control and inspection of steam boilers is not all desirable.

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* If the rivet is assumed to remain cylindrical while crushing the plate (or the rivet-hole while the rivet is crushed), then the amount of crushing, measured in the direction of the movement of the rivet, will be constant for all parts of the rivet-hole, and the crushing measured normally to the rivet surface will vary as cos *a*. This gives the variation of normal pressure assumed above.

* The number of ordinary stationary boilers in the United Kingdom, exclusive of those used for domestic and hot-house purposes, was estimated at 100,000.

† It is impossible to determine accurately the proportion of explosions in this country, but there can be no doubt explosions have decreased since the estimate previously quoted was made.

Government interference of any kind is in fact beset with difficulties. The most practicable form in which it could be efficiently carried out would probably be by enforcing the registration of all boilers, and their inspection either by competent public bodies such as already exist, or by private engineers possessing some recognised certificate of competency, the choice of the inspector being left to the steam user. By placing the registers in the hands of the Government Inspectors of Mines and Factories in the various districts, existing official machinery could be utilised to a great extent. These officers, as a part of their ordinary duty in the inspection of factories and other establishments using steam and ordinarily visited by them, could see that a certificate of the inspection and safe working condition of the boilers was in the possession of the owner before certifying to the satisfactory character of the arrangements of the establishment. The existing order of things would probably be least deranged in this way, and the periodical inspection of all boilers by independent persons might be thus insured. Legislation would, however, be required to accomplish even this, and the further interference of Government officials in the affairs of millowners and others would, undoubtedly, be strongly opposed quite as much by many of the owners of the best conducted establishments as by those whose ignorance or parsimony naturally lead them to regard with aversion any attempt at summary interference with proceedings which endanger their own lives and those of others. Parliament, presuming it to move at all in the matter, will moreover be exceedingly slow to resort to stronger measures than were advocated in the well considered proposals of the Committee of 1870-71, and, pending legislation, few will be disposed to question the good which is being done by our own and similar bodies.

As will be seen from the detailed account of the explosions for the past year, but one explosion for which this company were liable has occurred. Another boiler which has been insured with us has exploded; but the insurance in this case had become void from the removal of the safety valve by the owners of the boiler, a proceeding which no amount of inspection, Government or otherwise, short of the inspector being permanently retained on the premises where the boiler was used, could have prevented.

The one explosion for which we are liable—that which occurred at Halifax to an unsafe boiler, which together with three others of similar character, had unfortunately been accepted for insurance previous to my joining the company—has recently been made the occasion for an extraordinary attack upon this company and on Joint Stock Boiler Insurance companies generally, by the chief engineer of the Steam Users' Association (Mr. Fletcher), a professedly philanthropic institution which "guarantees" some 2000 boilers. This gentleman, ignoring the actual results of the experience of the companies he attacks, now repeats an accusation which is most concisely put in evidence which he gave before the Committee of 1870-71. He then expressed himself thus:—

"It is supposed that insurance companies have a direct interest in inspecting boilers and preventing explosions, because they pay compensation when an explosion occurs: that is a total fallacy. The insurance principle does not tend to the prevention, but directly to the promotion of steam boiler explosions; the less they do the more the profit; the more they do the less profits; inspection and insurance are directly at war."

In a recently published report which has been industriously circulated, and which is chiefly remarkable for the strange animus displayed by the writer in commenting upon successful rival institutions the charge is repeated, with much elaboration, "that the principle of insurance tends to the promotion of boiler explosion." This accusation, which appears to emanate periodically from the same quarter, has been refuted on previous occasions on the part both of this and other companies; and so far as the present transactions of this company are concerned, no more striking comment upon such a charge could be found than the fact that although one-fifth of the estimated number of stationary boilers in the whole of the United Kingdom are now insured with us, only one boiler for which we were liable has exploded during the past year, while the average rate of explosions for the year among the rest of the stationary boilers in the country, taking those at work at about 80,000, and including the handful of boilers "guaranteed" by the Steam Users' Association,* has been one in about 2200 boilers. It cannot be reasonably doubted that this result has been due to the care we have exercised in inspection, which, according to Mr. Fletcher is systematically ignored by the insurance companies. No less than 80,457 examinations, either external, internal, or thorough, have been made during the past year by the ordinary staff of inspectors employed by this company. It is necessarily impossible to institute any comparison between operations of this magnitude and the transactions of an association which, after a struggling existence of a quarter of a century, at the present time "guarantees" altogether about the same number of boilers as have been accepted by us for insurance during the past year alone.

It is perfectly plain that the Steam Users' Association has failed in competition with the joint-stock insurance companies, which have taken in hand boilers of every class throughout the kingdom, and have, with profit to themselves, been performing a really philanthropic work, while the Association has been expending its energies in futile attempts to force on legislation, in order to compel the owners of steam boilers to adopt a system which the best possible test, that of experience, has shown to be unsuited to the wants of the steam using part of the community.

To those who take an interest in the question of compulsory inspection of boilers, the German laws on the subject, translated by one of my staff, will be found to contain much valuable and suggestive information, and I therefore insert them as follows. So far as I am aware, they have not previously been published in English.

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* One of these is reported to have exploded, happily without loss of life.

The Boiler Laws of Germany of May 29th, 1871.

The Boiler Materials.

(1) The Boiler Materials not to be of cast-iron if the inside diameter be above 25 cms. (equal to 10 inches English) for cylindrical shapes, and 30 cms. (12 inches English) diameter if spherical. Brass is not to be used except for tubes whose inside diameters do not exceed 10 cms. (4 inches English).

(2) Flues.—The highest part or parts of all flues running round or through any steam boiler, to be at least 10 cms. (4 inches English) below the stipulated low-water level. For marine boilers, from 1 to 2 metres (3 feet 3⅜ inches to 6 feet 6¾ inches English) wide, this distance must be at least 15 cms. (6 inches English), and for boilers of a greater width 25 cms. (10 inches English).

The above regulations do not refer to boilers consisting of tubes of less than 10 cms. (4 inches English) in diameter, nor to flues when the plates in contact with steam are not likely to get overheated (red hot). As a rule, the hot gases should not be in contact with the plates above the water-level, unless the heating surface previously passed over is for natural draught at least twenty times the grate surface, and for artificial draught at least forty times the grate surface. Then the danger of overheating may be considered as excluded.

The Boiler Mountings.

(3) The Feed.—Each boiler to have a self-acting back-pressure valve.

(4) Each boiler to be provided with two independent and efficient feed apparatus, each of which must be able to supply the necessary feed water.

Several boilers in one group to be considered in this case as one boiler.

(5) Water Gauges.—Each boiler to have one glass water gauge, and a second apparatus to show the level. Each should have an independent connection with the boiler itself. If one connecting pipe be used for both apparatus it must be at least 60 square centimetres in area.

(6) If test cocks are used, the lowest to be placed in the plane of the lowest water level. All test cocks to be of straightway construction.

(7) Water Level Mark.—The lowest water level of every boiler to be distinctly marked on the glass gauge, also on the boiler or brickwork.

(8) Safety Valve.—Each boiler to have at least one efficient safety valve.

If a group of boilers have a joint steam trunk and cannot be disconnected separately from it, then two safety valves will suffice.

Marine, portable and locomotive boilers to have two safety valves. All marine boilers, excepting those on board ocean-going steamers, to have one of the safety valves accessible for examination from the deck of the steamer.

All safety valves must blow off at the stipulated pressure, and must be capable of being tested at any time.

(9) Steam Pressure Gauge.—Each boiler to have an efficient steam gauge, the highest stipulated pressure to be distinctly marked on the dial.

Marine boilers to have two guages one to be fixed in the stoke-hole and the other (except an ocean-going steamers) on deck, where it can be easily seen.

If there be more than one steam boiler on board a boat and the steam pipes are connected together, one pressure gauge on deck will be sufficient, in addition to the gauges fixed to each boiler.

(10) Boiler Maker's Name Plate to be fixed to every boiler, in a conspicuous place, and to give, besides the name of the maker, the maker's number, date of construction, and stipulated pressure.

The Boiler Test.

(11) Hydraulic Test.—Every new boiler must be tested by hydraulic pressure before it is bricked in or clothed. When the working pressure does not exceed 75 lb., the test pressure is to be twice the working pressure. When the working pressure exceeds 75 lb., the test pressure to be 75 lb. above the working pressure. The boiler to stand the test without taking a permanent set at any part. The test to be considered unsatisfactory if there be leakage in any other form than spray or small beads.

(12) Boilers which have been repaired at a boiler-maker's yard, or removed from their seating for any kind of repairs, must be subjected to the hydraulic test. If one or more new plates have been put in the furnace tubes of internally-fired boilers, or in the fire-boxes of locomotive boilers, or in cylindrical and ordinary (French) boilers, and it has not been necessary to remove them from their seats, it is still necessary to subject the boiler to the hydraulic test.

(13) Test Pressure Gauge to be open Mercury Pressure gauge, or the pressure gauge in the possession of the Government officer.

(14) The Boiler House.—All boilers which are to work at more than 60 lb. per square inch, and all boilers where the heating surface measured in square metres and multiplied by the steam pressure in atmospheres exceeds twenty, are not allowed to be placed beneath rooms where people are working.

Such boilers as may be placed below rooms where people are working are to be provided with an arrangement which will check the draught at once.

Excluded from the above regulations are:—Boilers which are under ground, in mines, and those on board ships; also boilers consisting of a diameter lesss than 10 centimetres (4 inches English).

(15) The Brickwork of the boiler to be 8 centimetres (3⅛ inches English) from the walls of the boiler house all round. This space may be closed over at the top and bricked up at the ends.

General Conditions.

(16) Excluded from the above regulations are:—

(1) All cooking apparatus heated by steam generated in another boiler.

(2) All superheaters or receivers where the steam is further heated by fire.

(3) All boilers in which steam is generated by fire, if they are connected with the atmosphere by means of an open pipe at least 8 centimetres (3⅛ inches English) in diameter.

Royal Decree Relating to the Working on Steam Boilers, May 3rd, 1872.

(1) All proprietors of steam boilers, or those entrusted in their behalf with the management of the same, and also those workmen having charge of them, are required to observe all the regulations under the conditions of which the working of the said boiler was granted. They are not to work boilers which are in a dangerous condition.

(2) Any one disregarding these rules will be fined 200 thalers (equal to £30), or be imprisoned for a term not exceeding three months.

(3) The proprietor of a steam boiler is required to have it examined by a competent officer. He is also bound to supply the necessary assistance and appliances, and he is to bear the expenses of the examination.

All necessary particulars for the proper and efficient carrying out of this Decree will be supplied by the Minister of Industry and Commerce.

(4) All Decrees not in conformity with this, and particularly "The Regulations of May 7th, 1856," referring to the working of steam boilers are herewith cancelled.

Berlin, May 3rd, 1872.

Extract from the Rules and Regulations for the Working of the Boiler Laws of May 3rd, 1872.

(1) Every boiler must be subjected to a technical examination periodically.

(2) This technical examination is to furnish particulars which will enable a correct idea to be formed of the state of the boiler.

(3) Steam boilers which are enrolled on the books of any of the Steam Boiler Supervision Associations sanctioned by the Government, are free from the official examinations.

(4) This freedom may also be granted to steam boiler proprietors who have made satisfactory arrangements for the periodical inspection of their boilers.

(5) The said Steam Boiler Supervision Associations are required to forward to the local authority a complete list of all members, number of boilers enrolled by each member, and number of examinations made during the year, and stating results obtained.

They are also to inform the authorities of every boiler added to or struck off their list.

Any published annual report to be forwarded to the Minister of Commerce.

(6) The official examination of the steam boiler is "external" and "internal."

(7) External.—The "external" examination is to be made every two years; the internal" every six years, when it is to be combined with the external. The external examination consists in an inspection of the mountings, working and attendance. The inspector is not allowed to interrupt the working of the boiler unless there are signs of dangerous defects which cannot be investigated without a stoppage.

(8) Internal.—The "internal" or "entire" examination, consists in a thorough examination of the whole boiler arrangement.

(9) If any irregularity be detected in the working of the boiler, the inspecting officer may order an extra examination to be made the following year.

(10) Four weeks' notice to be given of an intended "internal" examination.

(11) The "external" examination is to be made without giving any notice.

If the boiler is not prepared for an examination, and the owner does not carry out the instructions of the examining officer, the latter may have the working of such boiler suspended.

Any assistance must be rendered by the boiler owner free of cost.

(12) An "inspection book" to be kept for every boiler by the proprietor, and the results of the examinations to be entered by the examining officer in these books.

(13) The charges are as follows:—

For an "external" examination, 5 thalers (15s.)

For an "entire," that is, an external and internal examination combined, it is 10 thalers (30s.)

If the boiler be one of a group, the charges are:—5 Thalers for the first boiler, and half the amount for every following one. The examinations must take place for all boilers within the same year.

(14) The proprietor to bear all expenses for any "extra" examinations, as per 9.

(15) Charges and expenses (13 and 14) to be collected by the local authorites.

Berlin, June 24th, 1872.

SCIENCE AND ART.

Association of Municipal Engineers.—We are informed that the annual meeting of the Association of Municipal Engineers will be held at Leeds on the 27th, 28th and 29th of May next.

Art at the Mansion House.—The art conversazione at the Mansion House has been arranged to be held on Tuesday, May 25th. The whole of the Livery companies have placed at the disposal of the Lord Mayor for this occasion their pictures and other objects of interest, and the collection will be both an interesting and a valuable one.—*City Press.*

Melbourne International Exhibition.—A telegram has been received at the London offices from the Comissioners at Melbourne announcing that it had been found necessary to make a considerable addition to the main building, and that space would be found for the exhibition of agricultural implements. The allotments in that class have now been made, and the classes of British exhibitors in every section except that of art have been satisfied. A large additional area has recently been granted to the United States of America.

Lithographic Stones.—There is a very large demand for lithographic stone in the United States, and the supply has until recently been chiefly from Germany. Now, however, Canada will probably contribute a considerable share in this trade, for the quarries of Marmora yield a stone which is quite as suitable for lithographic purposes as that obtained from Germany. It has been tested by practical litographers, who say that its closeness of grain and general adaptability for the purpose will enable it to be used by lithographers with complete success.

Blackfriars Bridge.—We are glad to know that Mr. Edward Hart has a motion to lay before the Court of Common Council respecting the completion of Blackfriars Bridge. Sir Frederick Leighton, P.R.A., has, we believe, communicated with the Lord Mayor as to the unfinished condition of the bridge, and it is well known that ample means, now lying ready, have been provided for perfecting the structure and its accessories. Mr. Hart's desire is that Blackfriars Bridge be completed in accordance with the designs and provisions of the engineer, which would include the addition of appropriate groups of statuary to be placed upon the pedestals provided for that purpose at the extremities of the bridge.—*City Press.*

A Printers' Exhibition.—An exhibition and market of machinery, implements, and material used or sold by printers, stationers, and paper makers, &c., is announced to be held at the Agricultural Hall, London, early in July next. The exhibition will be very comprehensive, and as it is under the patronage of the *élite* of the trades which will be represented, will no doubt be a great success. Amongst the patrons are the Lord Mayor of London, the Lord Mayor of Dublin, theLord Provost of Edinburgh, the Lord Provost of Glasgow, Dr. Charles Cameron, M.P., President of the Company of Stationers of Glasgow, Mr. John Walter, M.P., Mr. J. W. Ingram, M.P., Mr. Edward Lloyd, Messrs. Waterlow and Sons, Limited, Messrs. Spottiswoode and Co., Messrs. Eyre and Spottiswoode; Messrs. Waterlow Brothers and Layton, Messrs. Bemrose and Sons, Limited, and Messrs. Marcus Ward and Co. The exhibition, being purely of a business character, will be free to the "trade," and the net profits will be paid over to the Printers' Pension, Almshouse, and Orphan Asylum Corporation.

Liverpool Engineering Society.—The usual fortnightly meeting of this society was held at the Royal Institution, Colquitt Street, on Wednesday evening the 22nd inst., Mr. Alexander Ross, president, in the chair, Mr. O. S. Pilkington read a paper on "Sewage," with details of a water-carriage system, and a few words upon sewage disposal. The author commenced by pointing out the advantages of a separate system of sewers for the surface water, but showed the necessity in some cases of combining the surface-water with sewage. He enumerated the precautions to be taken in the laying out of a water-carriage system of sewage, with reference to the contours of the land, number of buildings, rainfall, ventilation, cleansing of sewers, &c., and the necessity for keeping chemicals, steam, offal, &c., out of sewers, and described the means of doing so. The details of sewer construction were minutely described—such as the junctions, manholes, ramp syphons, flushing chambers and pipes, &c The materials best suited for this work were also described. House drainage and fittings were also touched upon, the necessity being shown for cutting off the noxious gases from the main-sewers, and the means of doing it; also means for ventilating private drains. Various house-traps were described. The author concluded his paper with a few remarks upon sewage disposal. The paper was extensively illustrated by diagrams.

Iron in Architecture.—On Monday evening a paper on "Iron as a Material for Architectural Construction" was read by Mr. James Allanson Picton, F.S.A., before the Institute of British Architects. The object of the paper was to trace out the use, progress, and capabilities of iron as a building material, and to inquire what influence these capabilities were likely to exercise on construction and design in the future. After reference to the wide diffusion of iron and its use in early times, the history of the metal was traced to the present time. The author commented on the little mention made of its use for architectural purposes, and pointed out that it was likely to be used to a greater extent in the future in architectural construction and design. The author could not agree with Mr. Ruskin that iron should be simply used for connecting stones together. The ultimate principle of all true architecture was to use materials within our reach in such a manner as would bring out their capabilities efficiently, for it was on this foundation that every style of architecture which had obtained a footing in the world had been based. The paper concluded by showing how in a variety of ways iron could be used, not only for the merely constructive portions of buildings, but for dome lights, galleries, entrance doorways, window balconies, &c. The engineer hitherto had enjoyed almost a monopoly of iron, but the architect, too, might put in his claim, as the material was plastic and ready to take any form that genius and taste might suggest.

The Use of Poisonous Colours.—The Council of the Society of Arts, having had their attention directed to numerous cases of reputed poisonings by arsenical wall-papers and other articles in general household use, have appointed a committee to inquire into the practicability of preventing the employment of arsenic in any processes by which it is allowed to remain in finished goods, and to obtain evidence as to the effect a total prohibition of the use of such processes, or the prohibition of the sale of articles produced thereby, would have upon various trades. To promote the object in view, the Committee has issued a circular to manufacturers of colours, dyes and others using colours in manufacturing processes, asking for information on certain specific points. The following are the questions to which answers are asked for, such answers to be returned to the secretary of the Society of Arts, John Street, Adelphi, London, W.C., on or before the 30th April:—(1) In what colours, dyes, mordants or other preparations used in trades or manufactures in this country, is any preparation of arsenic employed? (2) For what other purposes or processes is arsenic employed? (3) Do you attach any special importance to the continued use of any arsenical colours or preparations, such as leave arsenic in the finished goods; and, if so, what preparations and for what reason? (4) Would it be any disadvantage to you if the use of such colours, dyes, pigments or other arsenical preparations, both of home and foreign manufacture were prohibited; and, if so, what disadvantage?

The Campylometer.—This name, meaning a curve-measurer, is applied by M. Gaumet to a small pocket instrument he has designed, for giving at a single operation and by a simple reading (1) the metric length of any line, straight or curved, traced on a map or a plan; aad (2) the natural length corresponding to a graphic length on maps with a scale of 1-80000, or 1-100000, or on maps whose scales are multiples of sub-multiples of these. The instrument consists of a dentated disc, 5 centimetres in circumference, mounted on a micrometric screw in a frame, with handle. The two faces of the disc carry each a system of border divisions, the one being divided into forty, the other into fifty parts. The circumference of the disc corresponds to 4 kilometres on one of the scales just referred to, and to 5 kilometres on the other (1-40 of the disc on one scale, and 1-50 on the other, measuring 100 metres). As the disc passes over the line it is desired to measure, it moves laterally along the micrometric screw, and in front of a graduated scale in the frame. Its zero having at the outset been brought to that of the scale, one has merely (the movement being terminated) to note the last graduation of the scale beyond which the disc has stopped, and to add to the value of this graduation the complementary length furnished by the division of the disc opposite the scale. The advantages of such an instrument on military marches and in many other cases are obvious.

Art Exhibition at Amsterdam.—A very remarkable exhibition of objects on loan is now open in Amsterdam, namely, a collection of Dutch gold and silversmiths' work of the 16th, 17th and 18th centuries. The selection is good, the specimens well shown, and the characteristics of these various periods of art are well brought out. On no previous occasion has there been in Holland an opportunity of studying in one exhibition so varied and representative a collection of an art interesting from various points of view besides that of its technical importance. Many good examples of 19th century plate are brought together, and the artists—goldsmiths such as the Vianen and Lutma, of the 17th century—are also well represented by their works; the table plate of the 18th century is abundantly illustrated, a complete service for about sixteen persons being lent by Mr. T. P. Six, the descendant of the burgomaster immortalised by Rembrandt. Curious collections of silver toys, for which the Dutch have been famous, are shown, and these, including every object in miniature of household use and of trade appliance, are by no means the least interesting part of this very attractive exhibition. Among the lenders of important objects may be named the Grand Duke of Saxe-Coburg Gotha, who sends some rich specimens of jewelled and enamelled plate and personal objects; the Grand Duke of Mecklenburg-Strelitz, Mr. T. P. Six, Messrs. Becker, Dekking of Haarlem, and other known collectors or possessors of art treasures. The collection is shown at the Société Arti et Amicitiæ, and will be open for about two months.

International Fishing Exhibition.—This Exhibition was opened on Tuesday by the Crown Prince of Germany. Dr. Lucius, the Minister of Agriculture, delivered an address to the Crown Prince as the patron of the Exhibition, and having obtained his Imperial Highness's assent, declared the Exhibition open, and called for three cheers for the Emperor, to which the whole assembly enthusiastically responded, the band at the same time playing the Prussian National Anthem. Herr von Behr-Schmoldow, the president of the Exhibition Committee, subsequently proposed three cheers for the Crown Prince, which were responded to with equal cordiality. His Imperial Highness, escorted by the members of the Exhibition Committee, and followed by the company present, afterwards passed through all the departments of the building. The Exhibition, in which nearly all nations are represented, presents a splendid appearance and is complete in nearly all its details. Apart, however, from a few stuffed fishes and other objects sent by Mr. Buckland, an array of tinned meats, a fine case of hooks and other angling gear exhibited by Messrs. Bartlett and Sons, of Redditch fame, and a model Scotch herring boat displayed by Messrs. M'Combie, of Peterhead, with a wooden plan of their salting yard *in petto*, England is almost unrepresented. On the other hand, the Government of Washington eagerly embraced the proposals of the Fishery Society to take part in the scheme, and granted a sum of $20,000 to support the claims of the United States in the international competition. Some idea of the extent to which the Union has contributed to the Exhibition may be judged from the fact that no less than 250 tons weight of piscatorial material, valued at about $50,000, have arrived here from the other side of the Atlantic. Prominent among the exhibits is a whaling boat, fully equipped with all its gear.

Society of Telegraph Engineers.—At the ordinary meeting held on Wednesday last week at the Institution of Civil Engineers, Mr. W. H. Preece (President) in the chair, a very interesting paper by Professor Hughes entitled, "Note on some effects produced by the immersion of iron and steel wires in acidulated water," was read, in which were shown some very remarkable effects of the action of acids on iron and steel wires. It was shown that the mere dipping of a piece of iron wire in sulphuric acid rendered it highly brittle, and gave it many of the characters of steel. Professor Hughes also showed that iron used in conjunction with zinc in a single fluid cell made one of the most constant batteries known, and was almost entirely free from the disturbing effects of polarisation. An excited discussion took place, during which Mr. Chandler Roberts announced the fact that he had succeeded in extracting hydrogen of 20 times the volume of the iron in which it was occluded or absorbed, thus showing an intimate connection between hydrogen and the brittleness of the wire. Professors Abel, Adam, Ayrton, and Perry, Mr. Anderson (the president of the committee formed by the Institution of Mechanical Engineers to investigate the subject), and several others, took part in the discussion. The opinion seemed to be pretty general that we were on the right track to form some idea as to the reason of that strange alteration of iron which renders it steel. Professor Hughes's paper was followed by another by Mr. Stroh, in which some novel and very curious effects of currents of electricity were shown, by which wires, especially when of iron or steel, were welded or stuck together with considerable force, and in which the joints themselves possessed considerable elasticity. A strange click or noise was heard in these joints whenever a current of electricity passed through them, associating the effect with what is known as Hughes's microphone receiver. It was announced that Dr. Siemens, F.R.S., was engaged in pursuing his inquiries into the influence of the electric light on vegetation, and that he would shortly bring forward his most recent results, with some practical applications of dynamo machines to the fusion of metals in large quantities in the arc. The meeting was very well attended, and the subjects elicited a considerable amount of interest.

Sydney Exhibition.—The following telegram has been received by the Agent-General for New South Wales (Sir Daniel Cooper):—"Official declaration of awards; reception of judges at closing ceremonial; this day. The Governor, Ministers, Judges, both Houses of Parliament, and vast concourse of public attended; seven thousand awards declared officially. Address and gold medal presented to Governor; everything most successful; quite equal in *eclat* to opening ceremonial. Three cheers were given for the Queen, Governor, Lady Augustus Loftus, and the Executive Commission.—P. A. Jennings, Executive Commissioner." The following first lists of gold medals awarded have been also telegraphed: London Exhibitors—Arnold and Sons, Henry Bell, Berthon Boat Company, Brandram Brothers and Co., British Syphon Manufactory, J. B. Brown and Co., Burney and Co., Robert Canton, James Chambers and Co., H. Erhardt and Co., Farrow and Jackson, Feltham and Co., Field and Sons, Fyfe and Robinson, George Glover and Co., Charles Goodall and Son, London and St. Katherine Docks Company, Orient Steam Navigation Company, Price's Patent Candle Company, James Rolls and Sons, Sicker Safe and Strong Room Company, Spratt's Patent, Telegraph Construction and Maintenance Company, J. W. Thorley's Cattle Food Company, Frederick Walton. Provincial Exhibitors—Anglo American Tin Stamping Company, E. Ashworth and Sons E. P. and W. Baldwin, William Barrows and Sons, Beverley and Wylde, Bewley and Draper, Boulinikon Floorcloth and Manufacturing Company, C. Brandauer and Co., Cantrell and Cochrane, James Chesterman and Co., John Corbett, M.P., the Earl of Dudley, Thomas Garfitt and Son, Joseph Hamblet, N. Hingley and Sons, T. W. Hodges and Sons, James Howorth, Hutton and Co., Inman Steamship Company, Innes and Grieve, Pryce Jones, Leach, Flower, and Co., Lloyd and Lloyd, F. Longdon, and Co., Charles Macintosh and Co., M'Naught and Smith, William Marples and Sons, Musgrave and Co., John Richardson and Co., T. W. Rust and Co., S. R. Stewart and Co., Strachan and Co., Sykes, Macvay and Co., R. Turner and Sons, West Cumberland Iron and Steel Company, Wylie and Lochhead. The exhibition has been kept open by special desire five weeks beyond the six months contemplated. From the opening date (September 17) to February 26 the Exhibition had been visited by 803,084 persons, the daily average thus being 5736. At this rate the total admissions to the close would nearly attain 1,100,000.

Crystal Palace School of Engineering.—Within the South Tower of the Crystal Palace are several departments of a hive of practical industry. About seven years ago Mr. Shenton, superintendent of the art, science, and literary instruction given at the Palace, brought into operation a scheme for imparting practical knowledge of a preliminary character to students about to enter the engineering profession. Under the superintendence of Mr. J. W. Wilson, C.E., and his son, seventy pupils of about sixteen years of age, are conducted through the stages of preparing drawings, specifications, estimates, and plans, and are further instructed in the actual manual construction of models. The *ateliers* present an interesting array of plans of docks, bridges, railways, and various other engineering schemes. The leading idea of practical performance is carried out by sending pupils to the working management of marine engines, locomotives and mining machinery. An additional and peculiar feature is the instruction imparted by Mr. Ritson to gentlemen proposing to engage in colonial life. These are taught the essentials of self-help in the way of constructing huts, making hammocks, and fixing tents, and generally to provide for themselves. To such a complete extent is this department carried, that at the end of the ensuing term the gentlemen thus trained are placed on the island in the Palace lake, overgrown with brushwood, and tenanted only by the models of extinct animals, and are there left for a fortnight to live in dwellings raised by themselves, and on food of their own preparation. All divisions of the work of the school are reported to be highly successful. Wooden wheels, water wheels, models of engines, and actual working horizontal and vertical engines are proofs of what has been accomplished, and it need scarcely be said that pupils thus prepared are eagerly accepted in the offices of great engineering firms. The annual meeting for the presentation of prizes and award of certificates to the most proficient pupils of the school took place on Saturday last in the lecture-room of the South Tower. Professor James Stuart, M.A., of the University of Cambridge, occupied the chair, and there was a large company of ladies and gentlemen assembled, including several engineers and scientific gentlemen of eminence.—The Chairman, having distributed the prizes and certificates of proficiency and honour to the pupils in the several classes, congratulated the promoters of this School of Engineering and its principal, Mr. Wilson, on the development of practical and civil engineering which the productions of the pupils exhibited. He knew there was an opinion abroad that the profession of engineering was already overstocked; but he was prepared to assert that he considered it was by no means overstocked with competent persons, more especially those who were thoroughly enabled to combine the profession of a civil engineer with that of mechanical engineering, so essential, and which was one of the main objects of that school. If they referred back to the Exhibition of 1851, the superiority of English engineering over that of all other Continental nations was clearly shown; whilst, on the other hand, Continental nations equally excelled us in decorative art. It was only by the system of combining theoretical with practical and mechanical engineering that we could hope to maintain our superiority in this respect.—Speeches were also made by Mr. David Thompson, director; Mr. J. Emerson Dowson, C.E., and Mr. James N. Shoolbred, C.E., examiners, who had reported favourably of the progress and condition of the establishment; and by Mr. Wilson. It was stated by the latter that, of 313 pupils past and present, 66 are now receiving preliminary instruction; 105 are pursuing advanced studies with engineers; and 135 are gaining their livelihood by their profession.

MEETINGS FOR THE WEEK.

MONDAY, April 26.

Institution of Surveyors.—8 p.m. Discussion on Mr. C. G. Saunders's paper on Quantities and Quantity Practice.

Institute of Painters in Water Colours.—Noon.

Royal Geographical Society.—8.30 p.m.

Society of Arts.—8 p.m. Cantor Lecture. Mr. R. W. Edis, on Art Decoration and Furniture of the Entrance hall, Staircase, Dining-room and Library, Division of Wall Spaces, Examples of Treatment.

Piscatorial Exhibition.—Agricultural Hall. (Six days).

TUESDAY, April 27.

Royal Institution.—3 p.m. Mr. W. H. Scott, on Wind and Weather.

Institution of Civil Engineers.—8 p.m. Mr. Harrison Hayter, on the Amsterdam Ship Canal.

Society of Arts.—8 p.m. Foreign and Colonial Section. Mr. C. G. Lock, on Iceland and its Resources.

WEDNESDAY, April 28.

London Institution.—Noon. Anniversary.

Society of Telegraph Engineers.—8 p.m. 1. Mr. O. Heaviside, on the Resistance of Galvanometers. 2. Mr. C. Hockin, on the Determination of Faults in a Cable when there are more than one. 3. Mr. H. K. Kempe, on Testing by Received Currents.

Geological Society.—8 p.m.

Royal Society.—9 p.m. Conversazione.

Society of Arts.—8 p.m. Mr. Thomas Fletcher, on Recent Improvements in Gas Furnaces for Domestic and Laboratory Purposes.

THURSDAY, April 29.

Royal Institution.—3 p.m. Professor Tyndall, on Light and Colours.

Royal Society.—4.30 p.m.

Royal Society Club.—6.30 p.m.

Society of Antiquaries.—8.30 p.m.

Society for Encouragement of the Fine Arts.—8 p.m. Mr. C. J. Griffiths, on Wood Engraving, its Past, Present and Future.

Accrington Agricultural Society Show.

FRIDAY, April 30.

Royal United Service Institution.—3 p.m. Captain W. Gill, on the Chinese Army.

City of London College.—6 p.m. Dr. Heinemann on Political Economy. An Historical Survey and Summary Statement of its Leading Principles, the Writers in England and on the Continent of the 19th Century. With discussion.

Royal Institution.—8 p.m. Weekly Meeting. 9 p.m. Dr. W. Spottiswoode, Pres. R.S., on Electricity in Transitu.

SATURDAY, May 1.

Royal Institution.—3 p.m. Mr James Sully, on Art and Vision.

METALLURGY AND MINING.

The Whitehaven Hematite Iron Company are preparing to light two additional furnaces at their works at Cleator.

The Find of Coal at the Hamstead Colliery.—The secretary of the Hamstead Colliery Company (Limited) announces that the thick coal has been struck at a depth of 615 yards. Particulars as to the thickness and quality of the coal will be given as soon as they are ascertained. On Wednesday it was announced that the sinkers had gone ten feet through the thick coal. The seam is reported to be of excellent quality, and, it is anticipated, will prove to be the South Staffordshire 16-yard coal.

Coal Winning in the Dylas Valley, Neath.—On Saturday morning the famous Penygraig-Rosolven vein of steam coal was intersected in a shallow pit on Llwynllank farm. The property is leased by Mr. Lewis Lewis, mining engineer, who first discovered this famous vein of coal, which has proved 3 feet thick where it has been won. The area which Mr. Lewis has leased from the Llwynllank and Miers estate is something like 800 acres. Some five years ago Mr. Lewis sunk a pit on another portion of the property to a distance of 130 yards without discovering a trace of the coal. The coal is adjacent to the Neath and Brecon Railway, and is identical with that worked so extensively and profitably by Messrs. Cory and Yeo in the Neath Valley. The event was signalised by much rejoicing in the district.

Gold of South Africa.—The *Natal Mercury* says:—"Rumours are afloat regarding the discovery of gold in Zululand. It is quite true that a fine little nugget, weighing one ounce, has been brought in from the northern side of the Tugela, but it is quite premature as yet to say that a goldfield has been discovered. As for the Transvaal, our own correspondent at Pretoria writes under date February 21st:—"There are rumours of all kinds abroad as to large discoveries of gold being made, but these must be taken at a large discount. The fact appears to be established, however, that the old diggings at Spitzkop, &c., are 'looking up' again, for in one week 45 ounces of gold were taken out of the claim of Messrs. White and King, and 51 ounces in the following week. It is said that a far larger quantity has since been taken out of the same spot. There is undoubtedly payable gold in the Lydenburg district, but there is nothing as yet which will warrant people at a distance 'rushing' into the toilsome and uncertain life of gold digging."

South African Diamond Fields.—The following is from the *Natal Mercury*:—"From the Diamond Fields we learn that the mine at Dutoitspan has been sold for £6500, the highest price yet realised. The mine at Kimberley is now worked to the depth of 291 feet. The Administrator is taking steps to supply the mine with native labour. The mine at Kimberley does not probably cover more than 50 or 60 acres of superficial area, and yet that small plot is assessed at a value of £1,650,000. The estimate is, of course, more or less conjectural, as no one can say how deep in the bowels of the earth the 'diamondiferous' deposit may sink. So far there is no evidence of failing finds. The fact that a claim has sold for £6500 is sufficient proof of that, and this, although the mine has all but touched a depth of 300 feet. Diamond digging, as far as Kimberley is concerned, is a phrase of the past, the process being in every sense of the term a mining operation. Next to diamonds, potatoes seem to be the dearest thing on the Fields, £6 10s. having been given for a bag. It might be worth while to cultivate that sort of precious commodity along the fertile banks of the Vaal."

The Australian Gold Fields.—The *Melbourne Argus* says:—"The improvement in mining which has taken place during the past few months in the Ballarat district, consequent on the finding of new auriferous quartz reefs on what is known as Sebastopol Plateau at Ballarat, has been accelerated by the discovery in the claim of the Washington Company of a new reef, which so far as it has been tested has proved of great value. Quite a number of companies had for some time been working in that portion of the Sebastopol Plateau which extends north of the Band and Albion Consols and along the western boundary of the new Koh-i-noor, hugging the western edge of the plateau, where there is a steep descent to the Yarrowee Creekhat. These Companies, north of the Band and Albion and south of the Washington have been mining on a well-defined vertical lode, from which more or less moderately payable quartz has been obtained, and they are still working with good prospects. The Washington, which is the furthest claim north in which auriferous quartz has been worked at present, has proved an exception to all the others. The reef is different, being almost flat instead of vertical, and its quality is much better; while the progress of the company has been more rapid, and its success more decided. The claim extends for about 290 feet on the line of reef starting from the northern boundary of the Wilson's. The gold has proved on assay to be of extremely fine quality, and will yield the company considerably over the price of standard. On the other gold fields of the colony mining is being steadily pursued with generally favourable results."

Mineral Resources of India.—A company is being formed in Madras to work the gold reefs in the Colar districts. Reefs in that district, as in Wynaad, have long been known to and worked by the natives. They are said to be well defined, and to vary in thickness from 2 feet to 12 feet. The surface of the earth contains gold in minute particles, and some miners think that alluvial deposits may yet be discovered. Some ore taken from a reef in Colar now worked by the Ooregum Company gave over four ounces of gold to the ton. An important step has been taken towards the development of the resources of Assam by the concessions which the Government have granted to the newly-formed Assam Railway Company. The object of this company is to construct a railway from the Brahmapootra river at Debrooghur to Oadibya, with branches to Nagagoolie, Hopewell and Makum. The line will open an important tea district, and will establish communication between the terminus of the river steamers and some coal-fields which are believed to be of great value, and which are said to yield coal of a quality superior to that of the Bengal fields. The Government has agreed to grant the company for a period of 20 years such annual subsidy as may be required to make up, with the net profits of the railway, a dividend at the rate of 5 per cent. The subsidy is, however, in no case to exceed 100,000 rupees per annum when the whole line is open, and is to become payable as each section is opened, proportionately to the length of the section. The Government reserves the right to purchase the line at the end of five years from its completion, or after such succeeding period of five years, by paying the company 20 per cent. in excess of the value of the property as a dividend-paying investment.

Smelting Iron with Oil.—We extract the following from the Sharon (U.S.) *Herald* of the 2nd inst. A final, and what we call a successful test of the "oil fuel" question was made at the Fanny Furnace, in West Middlesex, on last Friday, by Professor Robertson. The furnace was not in what would be called first-rate condition; the gas was bad, and a few other minor matters interfered with the arrangements, and taking it altogether it was in bad condition for experiments. The feeding apparatus is simple in construction. The main tank contains about 4½ barrels of crude oil, which is pumped in by a hand pump at present. It stands about 100 yards from the furnace stack, and the oil is conveyed to the tuyeres by an inch gas pipe, where, by a series of valves and pipes, it becomes incorporated with superheated steam before entering the crucible. It passes into the tuyeres through the gate of the blow-pipe, about 1 inch above the plug hole, and has a capacity of from 10 to 100 gallons of liquid an hour to each tuyere. . . Looking through the glass in the gate we saw a beautiful volume of white flame, having all the appearance of a pure hydrocarbon. The flame moved with a very rapid motion, a motion that would seem to melt anything with which it came in contact. The volume ignited almost immediately after striking the blast in the blow-pipe. The two volumes, one of superheated steam and the other of oil, becoming one volume, and that volume burning, proves to any one having the least knowledge of chemistry that the burning volume is a pure bicarburet of hydrogen, which proves beyond a doubt that no water is transmitted into the crucible of the furnace by the oil. That crude petroleum is a dephosphoriser is admitted by all, and that the oil improved the gases of the furnace is another admitted fact, and we see no reason why the discovery of Mr. Robertson should not be utilised by all blast-furnace owners in this valley.

Gold of Queensland.—Australian papers give an account of the Woolgar River goldfield, which was discovered last year. The locality is described as being about 200 miles in a bee-line from Charters Towers, about 20° of latitude and between 143° and 144° longitude. Hughenden, between 144° and 145°, is said to be the nearest township. The Queensland Under-Secretary for mines received at the beginning of February a telegram from Warden Hodgkinson Georgetown, reporting as follows:—"I left the Woolgar goldfield at 8.30 p.m. last Friday, and arrived here at 8 o'clock last night, having been 36 consecutive hours in the saddle during heavy rain, and having ridden 160 miles over broken country, hastening to stop the rush, which at present is a madness certain to cause suffering, disappointment, and loss of life. The wet season is on now and the rivers are up, which means cessation of traffic and stoppage of supplies. A stage of 25 miles of the journey has to be made even now without water, and in the dry season the distance will be still greater. The track lies through bush and spinifex country. There are about 400 men now there on the ground. Some of the claims are very good, and the payable ground is taken up to the last inch; but there is a large extent of auriferous country for prospecting. The field will extend to the head of the Cambridge Creek, the Saxby, and the outlying spurs of the Main Range. The general character of the field is that the deposits are patchy and wide apart. The gold is found in intimate connection with conglomerate. I visited all the workings and found the gold coarse. Its price on the rush is £3 9s. per oz. I have announced liberal grants of reward claims to all parties who report fresh payable ground. I issued on the ground over 100 miners' rights, three permits for publicans' licenses, and two business licenses. The conduct of the community is orderly. The place is only fit for experienced northern miners inured to the climate, and accustomed to the mode of working our northern fields."

RAILWAYS & TRAMWAYS.

THE TAY BRIDGE DISASTER.

The Government inquiry regarding the destruction of of the Tay Bridge was resumed at Westminster on Monday before Mr. Rothery, Colonel Yolland and Mr. Barlow. The Court expressee a desire to receive evidence respecting the pressure of the gale from the Astronmer-Royal, Professor Stokes, Mr. Scott Russell and Sir Ralph Abercrombie. Mr. Henry Noble, Inspector of the Tay Bridge, in the employment of the North British Railway, was examined at great length. From his evidence it appeared that there was an inspector of the permanent way on the bridge, that he himself had charge of the foundations, and that there was no one whose special duty it was to take care of the columns or ironwork supporting the bridge. He had been apprenticed to a bricklayer, and had become an inspector, but he had no engineering skill. He voluntarily undertook, however, to overhaul the columns, and on taking soundings he noticed that the passage of a train produced a chattering among the iron bars. In all there might have been 100 cotters that he found loose and chattering, and these he tightened by packing a small piece of iron and driving it home. He had no instructions to interfere with the ironwork, and he did not consider his discovery of sufficient importance to be reported to the engineer of the company. The company were aware that he was getting the iron with which he repaired the defects. The chattering ceased after he had so tightened the cotters. He also discovered slits in four columns, one five feet long, and one from six to seven feet in length, and he repaired these with iron bands. He acquainted Sir Thomas Bouch with what he had done, and the latter visited the bridge a few days before the calamity, and "saw that the thing was then perfect." No engineer made periodical visits to the bridge on behalf of the company, and no one but the witness inspected it from May, 1878, to the time it fell. James Francis Hadland, formerly head clerk of the Cleveland Bolt and Nut Company, stated that the nuts and bolts supplied for the bridge were of ordinary Cleveland iron. The contractors did not specify that the best quality of iron should should be used, and they made no inspection of the work in course of manufacture. The iron ordered by witness's firm was to be good common iron, but they got in some instances very inferior metal, and they kept more of it than they returned. The contractors returned as defective a few small lots of bolts and nuts. He knew that money was sent as a bribe to the manager to prevent the return of inferior iron. George Wingate, furnace builder, said the bolts made by the company were generally good, but hundreds of inferior quality were sent out. The iron was always good enough, but it was deteriorated by overheating, and it was impossible to prevent the furnace boys from overheating the furnace. The inquiry was adjourned till to-day. The sunken girder in which the guard's van and a second-class carriage were caged was on Monday brought ashore at Dundee. The ironwork shows evidence that part of the train had been blown off the metals before the bridge fell.

At the sitting on Tuesday the principal witness examined was Mr. Henry Law, a member of the Institute of Civil Engineers. He had been instructed to visit Dundee, with a view of giving evidence in this matfer. He had examined the bridge thoroughly. From his examination he did not think that the piers had either shifted or settled. He had no doubt that the cement and materials used in the construction of the piers were good, and that the workmanship was good. He, however, found some of the joints unusually thick—some even nearly two inches thick. He also fonnd that, although the cement was of good quality, yet there had been very little adhesion between the stone and the cement. That was due to bad workmanship. Probably the stone was not wetted before the cement was applied. The stone was good hard calcareous stone. From calculations he had made, the strength of four holding-down bolts was about 350,000 lb. Therefore it was evident that the security of the columns depended upon the flanges and bolts. He thought the flanges and bolts, and the undersides of the heads and nuts should have been turned. All the surface in contact should have been faced. He had found great inequality in the thickness of the iron on the two opposite sides of several columns. The worst case was on the sixth column of pier 34. The thickness upon one side was only half an inch, and on the other side it was 1½ inch. This inequality was owing to the shifting of what was called the "top flask" in the moulding of the iron. Every column should have been examined with reference to its thickness. There was no difficulty in so doing. The construction of these columns could not have been properly supervised. He considered the practice of burning on "lugs" to be most reprehensible. One of the great objects of a metal founder was that no part of his casting should cool more quickly than another. With reference to the box girders, he would remark they were constructed of two groups of three columns, instead of forming one connected structure. If the box girders had been united the strength of the structure would have been increased, by the fact that there would have been less chance of the wind disturbing the pressure upon these groups of columns. There was no connection between the lattice girders, with the exception of longitudinal bars of wood of 18 inches width and 15 inches depth. The permanent way had been very carefully laid. In examining the structure he found in connection with the gibs and cotters that in many cases packing pieces of wrought iron had been introduced, either between the cotter and gib or between one and two cotters.

The inquiry was again adjourned. The court will test the quality of the iron used.

On Wednesday, Mr. Law, C.E., continued his evidence. He took the specifications for the construction of the bridge, commented on them, and showed the respects in which the work fell short of them. His tests are in some details to be verified, and he is to give the results with greater certainty in his evidence this morning. He afterwards proceeded to explain his report so far as it dealt with wind pressure, and he indicated a method of disposing the ties which would, in his opinion, have given greater strength at no great cost. The four forces to which the structure was liable to be exposed were those resulting from changes of temperature, from the weight of the structure itself, from the weight of a passing train, and from the lateral pressure of the wind. The second-class carriage, being the last but one in the train, had the least stability. It had eight passengers, whose average weight might be 140 lb. each. Taking into account the vertical pressure resulting from the action of the wind on the curved surface of the roof, the carriage could not have been overturned with a less wind pressure than 35·68 lb. on each square foot, and as in any position one-half or one-eighth of the surface of the carriage must have been sheltered, the actual wind pressure to overturn this carriage must have exceeded 40 lb. on the foot, without regarding any assistance which the couplings must have afforded to retain the carriage. Without any train and without any wind the pressure on the west rollers of the structure and on the east rollers would be the same (322,450 lb.), making a total pressure of 644,900 lb. With a train on the bridge under similar conditions the full pressure would be 955,230 lb.; but with a force of wind equal to 10 lb. the pressure on the west rollers without a train would be 300,190 lb.; on the east rollers, 344,710 lb.; total, 644,900 lb.; and with a train—on west rollers, 399,205 lb.; on east rollers, 456,695 lb.; total, 855,900 lb. With a force of wind equal to 20 lb. the pressure on the west rollers without a train would be 277,930 lb.; on east rollers, 366,970 lb.; total, 644,900 lb. With a train—on west rollers, 370,795 lb.; on east rollers, 485,775 lb.; total, 856,570 lb. With a force of wind equal to 30 lb. the pressure on west rollers without a train would be 255,670 lb; on east rollers, 389,230 lb.; total, 644,900 lb. With a train—on west roller, 342,385 lb.; on east rollers, 514,855 lb.; total, 857,240. With a force of wind equal to 40 lb. the pressure on west rollers without a train would be 233,410 lb.; on east rollers, 411,490 lb.; total, 644,900 lb. With a train—on west roller, 313,975 lb.; on east rollers, 543,945 lb.; total, 857,910 lb. These pressures were equally divided between one 18-inch and two 15-inch columns, and further modified by the horizontal pressures of the wind on superstructure, pier, and train. If it were assumed that the pier might by virtue of the system of bracing be considered as a rigid structure, and the effect of the bolts in holding down the columns be disregarded, then the wind pressure required to overturn the structure about the east 18-inch column as a centre would be 36·38 lb. without any train and 32·69 lb. on the square foot with a train over the pier. Unfortunately, the piers must have been very far from rigid, in consequence of the very imperfect manner in which the struts and ties were connected with the columns. The struts consisted of channel irons, placed back to back with the lug of the column between, and connected therewith by two 1⅛-inch bolts at each end; the holes for the bolts were cast 1¼-inch in diameter, and being rough and larger than the bolts, and the ends of the struts having no bearing surface to abut against, the struts themselves were offly retained in their positions by the pinching action of the bolts. But the security thus afforded must have been very slight; because, owing to inequalities in the surfaces of the lugs themselves, and to the fact that in some cases the holes in the struts had been roughly enlarged with a blunt tool so as to leave a burr, the actual bearing surface of many of the struts against the lugs was very small. The flat ties, when the structure was first erected, were tightened up by means of gibs and cotters; but, owing to the slots in the bars against which the gibs and cotters bore being rough, and the gibs and cotters also roughly forged, and, further, owing to the holes cast in the lugs not being cylindrical, and to a screwed bolt being used to secure the ends of the ties instead of a pin, the real bearing surface was exceedingly small, and a comparatively slight strain would suffice to crush the edge of the hole in the lug into the thread of the screw. In reference to the tie-bars, the bearing surface of the gib against the slot in the bar was quite inadequate; for, while the area of the section of the bar exposed to a tensile strain was 1·625 square inches, the bearing surface of the gib being in compression should have had an area of 1·86 square inches, whereas it had only a surface of 0·375 square inches, or about one-fifth of the strength of the bar. It resulted that a lateral pressure against the columns would produce movement in the struts and ties, leading to the latter becoming slack, and this movement actually did take place. In some of the tie bars still standing he found packing pieces of iron a quarter of an inch in thickness had been introduced between the gibs and cotters, and on enquiry he learned that these had been introduced from time to time since the opening of the bridge. From the accounts which have been furnished to him it appeared that about 150 of these packing pieces were inserted in the ties between the middle of October of 1878 and the time of the bridge falling, and that the necessity for them arose before the bridge had been opened five months. This circumstance clearly showed that there must have been a considerable racking movement in the piers under the united action of passing trains and wind, and he could not but consider it to point to the primary cause of the disaster. For the slackening of these ties and struts meant the removal of that condition upon which alone the power of the structure to resist being overthrown by a lateral pressure depended. And it was easy to conceive that a storm of the violent character of that of the 28th of last December would produce such movements, in the connections of these struts and ties with the columns, as would render the columns unable to sustain the additional weight of the train and the lateral pressure of the wind. An examination of the ruins of pier No. 32, being that over which the train was situated when the structure fell indicated that the columns doubled up about their joints as the lower lengths of the westward 15-inch columns were pushed over to the west, or in the reverse direction to that in which the rest of the structure fell. A similar action in pushing back the westward columns was seen in piers No. 36, 39 and 40. The present state of piers Nos. 29 and 31 afforded conclusive proof of a weak point existing in the structure at the time of the overthrow in each of those piers—namely, in pier No. 29 at the level of the top of the second tier of columns, and in No. 31 at the top of the lower tier; for the strain at the point of fracture was, in the former case, only 5-7ths, and in the latter case only 6-7ths, of the strain at the base of the pier, while theoretically the strengths of the pier at the base and the points of the fracture were the same. It was clear, therefore, that the power of resistance of these two piers had been reduced at the points of fracture in the case of pier No. 29 to the extent of 2-7ths, and in the case of pier No. 31 to the extent of 1-7th, of their normal power of resistance. Considering that the columns were 76 feet in height, that with a wind pressure of only 20 lb. on the square foot, a pressure of 337 tons would be thrown upon the eastward 18-inch column at the time of the passage of the train, and that a horizontal pressure of 37½ tons was acting against the top of the column, it is easy to conceive what must have been the inevitable consequence of any slackness on the part of the ties. Owing to the double angle which the ties by which the the 18-inch columns were braced made, with the direction of the force tending to overthrow the structure, the efficiency of these ties was reduced to the proportion of 1 to 2·73, or to little more than one-third of their full strength, and any elongation or movement of the ties would allow of nearly three times that movement in a horizontal direction in the point of the column to which they were attached.

The Krahberg Tunnel.—From the Odenwald, Hesse, it is reported that the new line which is to connect the Neckar Valley Railway with that of Odenwald will contain in the Krähberg Tunnel the second longest work of the kind in Germany. It will run from the Nümling valley to the Itter valley, and will be 3100 metres in length. The longest tunnel in Germany is the "Emperor William" tunnel on the Moselle line near Cochem, which was completed in 1877.

The St. Gothard Tunnel.—Of the workmen hitherto engaged upon the tunnel, whether at the Göschenen or Airolo ends, nearly 500, who were suffering from what is called the tunnel disease, had left by the beginning of the present month, and have gone to seek renewed health in their homes in Italy. On their departure they were presented by the company with gratuities varying from one hundred to two hundred francs each. The only event of note which has recently occurred within the tunnel was the fall of a large mass of rock, on the 6th inst., by which one man was killed, and five more or less seriously injured.

Railway Omnibuses.—The London and North-Western Railway Company are beginning a new and useful experiment. They have provided small one-horse omnibuses, capable of carrying six passengers inside and two outside, together with luggage, to meet their principal express trains arriving at Euston Station, to convey family parties to any part of London. These vehicles will also be sent to the hotels in the City and West-end, as well as to private residences, to convey passengers to Euston Station in time for any of the down trains on the London and North-Western line. Applications for the omnibuses may be made by letter or telegram to the station-master at Euston Station. The scale of charges will be 1s. per mile, with a *minimum* charge of 3s.; and as the vehicles are nicely fitted up and will supply a want much felt by the travelling public, doubtless the experiment will meet with support.

The Tay Bridge.—Numerous proposals have been brought forward with the view of solving the all-important problem of how the Tay Bridge is to be put up, and how its safety is to be secured. The latest proposal is by Mr. J. P. Walker, 32, Baker Street, Stirling, late of London, who has constructed a model showing how the Tay Bridge could be put in working order at a small expense. The model which he has made only shows one of the centre or 250 feet spans. It is not intended to alter the parts of the bridge at present intact, but merely to reconstruct, on a different scale, the part which has given way. The apparent defect of the bridge, as disclosed by the accident in December last, was the construction of the main spans. It is to these Mr. Walker has directed his attention. The columns supporting the ends of each girder are two in number, each being six feet in diameter, and bound together by iron bands. The pillars or columns are each to be ninety-two feet high, or twelve feet above the level of the bridge. The main object of the inventor was to get the 250-feet girders below the centre of gravity, and he proposes to accomplish this by means of suspending the girders at either end. To support the girders strong iron bars will be required, but Mr. Walker is confident that there will be no difficulty with this. The bars will rest on the top of the columns, and the girders suspended from it by links. Expansion and contraction are thus provided for, and any lateral motion that might occur will not endanger the columns. To increase the strength of the girders, instead of having the network or crossbars as before, it is intended to have vertical rods connecting the top beams with the girders below. The level of the bridge is not interfered with, and Mr. Walker thinks if the law of gravitation had been strictly adhered to at first, the accident would not have taken place.

ELECTRICITY, TELEGRAPHY

The Atlantic Telegraph.—The Telegraph Construction and Maintenance Cympany's screw-steamer *Scotia*, Captain Cato, which left London for the south-west coast of Ireland on Saturday, the 10th inst., for the purpose of repairing the cable laid for the Anglo-American Telegraph Company in 1873, succeeded, says a telegram to Lloyd's, in restoring communication upon that cable on the evening of the 15th.

New Electric Lamp.—A New York despatch dated the 20th says: Sawyer's new electric lamp for household illumination, which was publicly exhibited Tuesday evening last, continues nightly to attract attention. An exhibition was made last night to a party of gentlemen from Boston, Philadelphia and Washington. The light is pure and steady and easily regulated. The form of the lamp decided upon consists of a clear glass tube 10 inches long and 2 inches in diameter, closed at both ends and imbedded in a nickel-plated base, which is provided with a threaded cavity for screwing on to any ordinary gas fixture. The cost of the construction is estimated at $1·25 per lamp, and the selling price between $2·50 and $3. The cost of the electric light is estimated at one-fourth that of gas.

Progress of Electric Lighting.—The Brush electric light has been introduced into the South Kensington Museum, and the results are very satisfactory. The experiment has been tried in the hall now best known as that containing the new fresco by Sir Frederick Leighton, P.R.A. There are eight lamps, three suspended on each side and two in the central line, so that the light is equally diffused. It is expected the lamps will be used on Saturdays, Mondays, and Tuesdays till 10 p.m. The use of the electric light is spreading. The Victoria Docks and Holyhead Harbour are to be lighted by electricity. The Royal Navy is adopting Brush's light. Siemens' light has been introduced into the Siam Dispensary, Bangkok, as a rival to Jablochkoff's. The arrival of spring has brought with it a discontinuance of the Siemens light in the reading room of the British Museum until next autumn. The authorities regard it as a good success.

Electric Light Experiments.—The *Gibraltar Chronicle* of the 5th inst. says:—"On Saturday night, at 9.30 o'clock, to the great astonishment of those who were not prepared for it, but who happened to be looking towards the bay, a brilliant light was seen to burst forth suddenly, shooting out a prolonged ray across the water and on to the Rock, which it lighted up in a most vivid manner. This was soon followed by a second similar light at some little distance from the first, and it soon became evident that they were electric lights, and proceeded from Her Majesty's ships *Minotaur* and *Agincourt*. The practice that followed with these lights, and which was continued for nearly an hour, was interesting in the extreme; for there was not a hole or cranny on the western face of the Rock, from the water to the signal-station, that was not searched out and illuminated as if by magic; nor was there a vessel or a boat in the bay that did not undergo the same minute examination. Owing to the concentration of the light at the instrument necessary to permit of its rays being reflected to a distance, the sphere of its action is unavoidably limited; and it hence becomes necessary to search the water or the shore gradually and methodically, in such a manner as to insure no spot being left unlighted. Thus the drill in itself is intricate, and requires considerable practice. There is one point which cannot fail to strike even the uninitiated, which is that, during such time as a vessel displays the electric light, she is, while illuminating the batteries of her opponents, an excellent mark for their guns."

NAVAL ARCHITECTURE.

LAUNCHES.

English.

Sahara.—On the 13th April there was launched from the shipbuilding yard of Messrs. C. Mitchell and Co., Low Walker, an iron screw-steamer, named the *Sahara*, and on the 14th the sister vessel *Sheikhi*, launched by the same builders a month ago, made her trial trip at sea. The two vessels are identically the same in all respects as regards both hull and machinery, and have been built for the Bedouin Steam Navigation Company, Liverpool, of which Messrs. W. and R. Thompson are the managing owners. The vessels are capable of carrying 3000 tons deadweight, and although built to the highest class at Lloyd's, have additions even beyond the requirements of that society. The vessels embrace all the latest improvements for rapid and economic working, including steam steering gear, &c. The machinery has been constructed by the Wallsend Slipway and Engineering Company, and during the run of the *Sheikhi* at sea worked with the greatest smoothness, and propelled the vessel, which was in ballast trim, at a mean speed of 11·2 knots.

Scotch.

Valencia.—On the 13th April Messrs. Blackwood and Gordon launched from their shipbuilding yard at Port Glasgow a screw-steamer constructed of steel. The following are her dimensions:—245 feet by 33 feet by 17·6 feet, and will carry about 1800 tons. This steamer has been specially built for the copper ore trade, and is named the *Valencia*. She is owned by Messrs. Moffat, Ardrossan and Henderson, Belfast, and will be supplied by her builders with compound engines of 130 horse-power.

Trial Trips.

Jorge Juan.—The new Spanish steamer *Jorge Juan* which was lately launched by Messrs. A. M'Millan and Son, Dumbarton, for Messrs. Glanno, Larrinaga and Co., of Barcelona, went down the Clyde on the 15th of April for a trial of her engines. The principal dimensions of this vessel are:—Length 220 feet; breadth 30 feet; depth 18 feet. She has been fitted by Mr. Rowan, of Glasgow, with engines having cylinders 29 inches and 56 inches, with a stroke of 3 feet. The trial was in every way satisfactory, everything having worked with the greatest smoothness. The *Jorge Juan* is fitted up for about thirty first-class passengers.

Progress.—On the 17th of April the screw-steamer *Progress*, launched at Greenock for the Great Northern Fish Carrying Company by Messrs. Murdoch and Murray recently went down the Clyde on a trial trip. This is the second of four boats for the same company. The rate of speed attained by the *Onward* the first of the order, was somewhere about 14 knots, and it is expected that the whole of the boats will be very speedy.

Disasters at Sea.—There were 21 British and foreign wrecks reported during the week ending Saturday last, making a total of 470 for the present year, or a decrease of 125 as compared with the corresponding period of last year. The approximate value of property lost was £630,000, including British £520,000.

The Steam Shipping Trade.—During the past week no fewer than thirteen large steamships left the Mersey for

North American ports with a large number of passengers and considerable general cargoes. Most of the steamers were bound for the United States. It is believed to be unprecedented that so large a number of Atlantic steamers should leave Liverpool at this season.

New Canals in Germany.—The *Gazette de l'Allemagne du Nord* states that the following new lines of canals have been surveyed and will probably be shortly undertaken from the Rhine to the Moselle. Canalisation of the Maine between Frankfort and Mayence; from the Rhine to connect with the Weser and Elbe; from the Ems to the Jahde; from the Elster to the Saale; from the Elbe to the Spree; from the Oder to the Spree; from the Danube to the Oder; and canals connecting Rostock and Berlin, and Stettin with Berlin.

National Lifeboat Institution.—The annual report of the National Lifeboat Institution states that during the past year twelve new lifeboats have been placed at various stations on our coast, which are now nearly everywhere provided with lifeboats wherever their services would be useful and it would be practicable to work them. The committee are therefore now able to turn their attention to the gradual replacement of old and inferior boats by those of the latest and best construction. During the past year the lifeboats of the institution have rescued 637 persons from drowning.

The Old Wooden Converted Ironclads.—It has been determined by the Admiralty to sell out of the service a fourth of the old wooden converted armourclads. This is the *Favorite*, which is now lying "unappropriated" at Portsmouth, and which was launched at Deptford in July, 1864. She is a central battery ship, measuring 225 feet in length by 46 feet 9 inches in beam, and has a tonnage of 2186 tons. She cost in hull for labour and materials £122,423, and was engined by Humphrys and Tennant for £24,000. Altogether, including fittings and equipments, the outlay upon her amounted to £173,000. It is intended to dispose of these ships with the engines on board, and with as many of the fittings as possible, in order to increase their value to purchasers, who will probably be found among the South-American Republics.

The Japanese Navy.—In the *Japan Directory* for the current year, published at Yokohama, a list of the twenty-four vessels at present comprising the strength of the Japanese Navy is given. It is as follows:—"Adzuma-Kan, ironclad, screw, 700 tons, three guns, 500 horse-power; Amaki-Kan, fourth rate, screw, 908 tons, nine guns; Asama-Kan, third rate, screw, 1104 tons, twelve guns, 300 horse-power; Chiyoda-gata-Kan, sixth rate, 100 tons, three guns, 60 horse-power; Fujiyama-Kan, third rate, 1000 tons, thirteen guns, training sailing ship; Fuso-Kan, twin-screw, armour-plated, second rate, 3740 tons, 3500 horse-power, twelve guns; Hiyei-Kan, screw, third rate, composite corvette, 2200 tons, 2500 horse-power, thirteen guns; Hosbo-Kan, fifth rate, screw, 173 tons, four guns, 60 horse-power; Iwaki-Kan, screw, 600 tons, 650 horse-power, three guns (now building at Yokoska); Jinjei-Kan, P. W. Imperial yacht,; Kaimon-Kan, 1490 tons, 1250 horse-power, compound engine, eight guns (now building at Yokoska); Kasuga-Kan, flagship, fourth rate, paddle wheel, seven guns, 300 horse-power; Keuko-Kan, fourth rate, screw training ship, 300 tons; Kongo-kan, screw, third rate, composite corvette, 2200 tons, 1500 horse-power, thirteen guns; Mosniun-Kan, fifth rate, 305 tons, four guns, 100 horse-power; Nisshin-Kan, fourth rate, screw, 784 tons, eighteen guns, 250 horse-power; Raidem-Kan, old, 240 tons, 80 horse-power, four guns; Riojo-Kan, third rate, iron belt, screw, 1459 tons, fourteen guns, 280 horse-power; Set'tsu-Kan, fourth rate, store ship; Sei-Ki-Kan, fourth rate, screw, 898 tons, eight guns, 180 horse-power; Scooriu-Kan, yacht; Teibo-Kan, fifth rate, screw, 125 tons, five guns, 60 horse-power; Tenrio-Kan, 1490 tons, 1250 horse-power, compound engine, seven guns (building at Yokoska); Tuskuba-Kan, third rate, screw, training ship, 1033 tons, twelve guns, 200 horse-power."

The Panama Canal.—On Saturday last M. de Lesseps gave an account of his Panama trip last night to the French Scientific Association, and was enthusiastically received. He stated that the only appreciable difficulty in the way of the canal was a hill thirty-six metres in height, which separated the Rio Chagres valley from the Rio Grande valley. As an engineer for thirty years, he could affirm the feasibility of the scheme, and his reception in the United States had shown that their adhesion was now gained. Twenty years ago the Rio Chagres swamps would have been an obstacle, but the powerful dredges invented for the Suez Canal, where they cleared a distance of forty-four kilometres in the Bitter Lakes, would easily deal with those. As for the occasional inundations of the Chagres, nature had placed the remedy close to the evil; for an embankment between two mountains would intercept the streams producing the floods. Panama had never been visited by earthquakes, for it was outside the volcanic region, the stability of the Cathedral being a proof of this, and the alleged insalubrity of the isthmus was refuted by the perfect health of his party of nearly 150 persons. Although often wet through, they never had fever. As for the Colon Railway costing the lives of coolies, there was simply a suicidal mania among the thousands of Chinese. Home sickness induced some to bury their savings at the foot of a tree and hang themselves on the branches, fancying that they would wake up in China. Climate had nothing to do with it. At Panama he knew a family of 19 girls, another of 14, and a woman who, though still young, had 50 grandchildren. M. de Lesseps wound up with a humourous account of his United States experience. He was besieged by reporters, and received the utmost courtesy on all hands, the Chicago hotel-keeper refusing to take any payment or even to present himself to be thanked. On his explaining that he acted under the concession of the Columbia Government, that no other Power had anything to do with it, and that the management would rest with whoever chose to become shareholders, all promised their support, and he had 300 millions pledged to him for subscriptions in America. The canal would be made by France, with the co-operation of all the world.

Merchant Shipping.—In his annual report to the Board of Trade on Navigation and Shipping, Mr. Giffen says there was an increase in 1879 of the average tonnage of ships in the trade of the country, and there are other facts showing a tendency at the present time for the average size of ships to increase, which has some connection in fact with the increasing preponderance of steam ships in the trade of the world. The increasing preponderance of British vessels is quite as manifest in the foreign trade of the country as it is in the coasting and foreign trade combined. Taking the foreign trade only, we find that the entries of British ships in 1879 comprised 26,927 vessels of 18,514,559 tons, showing a decrease of 298 vessels along with an increase of 1,186,817 tons in the tonnage, the increase in the total tonnage entered in the foreign trade having been only 738,871 tons. Similarly clearances of British ships in the foreign trade in 1879 comprised 37,540 vessels of 18,919,441 tons, showing a decrease of 268 vessels along with an increase of 955,691 tons in the tonnage, the increase in the total tonnage cleared in the foreign trade having been only 381,500 tons. British vessels having thus increased, there was a decrease in foreign vessels. The amount of foreign tonnage entered and cleared at ports in the United Kingdom in the foreign trade has hardly increased since 1874, while the proportion has declined from about 34 to only about 30 per cent., the amount and proportion of British tonnage having as steadily increased. Allowing for the greater effectiveness of steamers it may be stated broadly that while between 1840 and 1850 the additions to the sailing fleet greatly exceeded in amount the additions to the steam fleet, and between 1850 and 1860 were just about equal to these additions; after 1860 the additions to the steam fleet were enormously in excess of the additions to the sailing fleet, and since 1870 they have been virtually equal to the present sailing fleet, which has meanwhile somewhat diminished. Coincident with this change there has been a relative increase of the proportion of British shipping, and of the business done by it to that of the rest of the world. Mr. Giffen adds:—"Since 1865 there has been no increase in the aggregate employment given by our shipping. There is no doubt, moreover, that the nature of the employment is being completely changed, steamers requiring engineers and stokers and more skilled officers than sailing vessels. The diminution is principally, it will be observed, in small sailing vessels in the home trade. Other causes as well as the increase of large steamers, may, of course, have co-operated in this change, but the point to be observed is that a great increase in our mercantile fleet, such as has undoubtedly occurred, if we measure by effectiveness, might have been expected to cause a proportionate increase of employment; but, owing to the peculiar character of the increase of the fleet itself, there has been no such increase in the number of persons employed. When the transformation is complete, the increase of employment may be expected to go on *pari passu* with the increase of steam vessels themselves, but until now the whole change is evidently being accompanied by a remarkable economy in labour. With regard to the shipbuilding in 1879 compared with previous years, it appears that the building of steamers last year compared with sailing vessels was as 5 to 1—297,720 tons of steam vessels to 59,153 tons of sailing vessels. Considering the greater effectiveness of steamers the disproportion is enormous. For several years past it will also be observed that there has been a decrease in the number of sailing vessels built, and an increase in the number of steam vessels. In 1876, while the total building was much the same as in 1879, the tonnage of sailing vessels built was 236,890 tons, and of steam vessels 123,475 tons, as compared with 59,153 tons of sailing vessels and 297,720 tons of steamers in 1879, the proportions being thus entirely changed in the years in question."

ARMS, ARMOUR AND EXPLOSIVES.

Palliser Shot.—During the last 15 years 50,000 tons of the Palliser shot have been made for the fleet and coast defences of England and her colonies. A Parliamentary return for 1877 shows that their cost was £15 2s. a ton. They appear to have superseded steel shot and shell about 1867, during which year a Parliamentary return of May 10th shows that 1500 tons of the latter were made at a cost of £92 10s. a ton. Steel projectiles could be made cheaper than that now; still the saving to the country has been calculated by a well-known civil engineer and expert to amount to the enormous sum of three millions sterling.

The New Breech-loading Guns.—The new breech-loading guns ordered to be constructed at the Royal Gun Factories in the Royal Arsenal, Woolwich, are making satisfactory progress towards completion, and the first battery of 13-pounders manufactured on the new principle will be ready for trial in about a week. The six guns are of extreme length, 89 inches over all, and 84 inches in the bore. The diameter of the bore is 3 inches, enlarged to 3½ inches in the powder-chamber, which is 11 inches in length. The 9-pounder muzzle-loading field guns which the 13-pounders are intended to replace, are likewise of 3 inches calibre, unchambered, and but 66 inches long in the bore. Consequently the new guns contain six diameters more space for the expansion of the powder-gases than those which they are to supersede, in addition to the extra room obtained by chambering. The breech-loaders next in size will be 25-pounders, only one of which is at present being made. The largest gun of the series will be the 43-ton breech-loader, which will be 27 feet 6 inches in length over all, the bore being 26 feet long. The diameter of the bore will be 12 inches, except in the powder chamber, which will have a calibre of 12½ inches for a length of nearly 6 feet.

Institution of Surveyors.—At the ordinary general meeting of this Society, held on Monday, April 12th, a paper was read by Mr. C. G. Saunders (member) on "Quantities and Quantity Practice." A discussion ensued, which was adjourned to the next meeting, and a vote of thanks was unanimously passed to Mr. Saunders for his paper.

OFFICIAL NOTICE.

All payments for Subscriptions, Advertisements and General Accounts are to be remitted to the **Office, 161, Fleet Street, E.C., London,** Cheques and Post Office Orders to be made payable to Perry F. Nursey, and crossed "London and County Bank."

Advertisements and other Business Communications to be addressed to the Publisher.

To ensure insertion, Advertisements should reach the Publisher not later than Thursday morning.

Communications on literary subjects and books for review are to be forwarded to the Editor. Anonymous correspondence will be wholly disregarded, and the return of rejected MSS. cannot be guaranteed.

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THE UNITED STATES.

Messrs. Willmer and Rogers, Beekman Street, New York, will supply thick or thin paper copies of IRON on application.

TO READERS AND CORRESPONDENTS.

SPECIAL NOTICE.

The Foreign Iron Trade of 1879.

On Friday, May 7th, being the last day of the Spring Meeting of the Iron and Steel Institute for 1880, a special number of Iron will be published, which will contain a full account of the Meeting of the Institute, with the papers read up to the 6th prox., and reports of the discussions upon them. With this number a special supplement will be published, which will contain, in addition to the usual trade reports, special reports from the Continent on the Iron Trade of 1879, prepared by well-known authorities on the subject, resident in the countries upon which they will respectively report. It is felt that the publication of these reports will meet a want which has been experienced at the last few meetings of the Institute, and of the Iron Trade Association, and, conjointly with the report of the Institute Meeting, will afford the most complete view of the actual position of the iron trade.

NOTICES OF BOOKS.

A Guide for the Electric Testing of Telegraph Cables. By Capt. V. Hoskier, Royal Danish Engineers. Second edition. London: E. and F. N. Spon. 1879.

This is calculated to prove a useful manual for juniors in the telegraph service. In it will be found the most approved methods for the testing of electric cables during their manufacture and the process of laying them, a description of the apparatus used in testing, tables giving the formulæ of each process and a series of diagrams. The author has had much practical experience in telegraphic work, and has proved the data given in his book while superintending the manufacture of about 3500 nautical miles of cable.

A Treatise on the Construction, Rigging, and Handling of Model Yachts, &c. By Tyrrel E. Biddle. London: Charles Wilson. 1879.

The sailing of miniature ships is not altogether confined to schoolboys; for on some parts of the coast the rigging and racing of these small craft is a favourite amusement among grown-up people. And it is a much more sensible recreation than the kite-flying which is practised even by greybeards in China. In sailing model yachts there is room for a good deal of nautical skill; and experimenters in naval matters work out their theories upon models before applying them to big ships, failure in which is a rather costly affair. Miniature yachtsmen do not in every case purchase their craft from the regular builders, but are frequently their own shipwrights, and it is for the use of such amateurs that the present work is intended. The instructions are full and complete, including designing, drawing the lines, constructing, finishing, rigging, &c. There is also a chapter on yachting, and another on the management of open boats, which will be valuable to our amphibious youth, and a copious glossary of nautical terms, illustrated when necessary with engravings, and full-page plates, on which are shown the ropes, sails, and spars of a cutter, yawl, schooner, merchant ship, &c.

Dickens' Dictionary of Continental Railways, &c. London: Charles Dickens.

The English Bradshaw is a puzzle to most people, and its Continental representative is ever so much worse. How grateful, then, must the untravelled Briton be to the publisher, when, for his first Continental excursion, he receives all the principal routes through Europe presented in the clear and simple style of the ABC Guide. About thirty-five important Continental towns have been selected as centres of travel, and from each of these the lines to the localities most frequented by tourists are shown, the average being about forty to a centre, and the number of routes being consequently about fourteen hundred. Besides, as nearly every radial town of one centre works in with one of some other centre, combinations can be readily effected. A plan or diagram of the chief routes is also given. In addition to the railway information, there is a great deal of useful subsidiary information—advice how to save trouble and expense in travelling, passport regulations, official residents at places mentioned in the Guide, London cab fares, lists of good hotels, time-tables of Swiss diligences and the times of sailing of river, lake and ocean steamers.

The Great Artists: The Figure Painters of Holland. By LORD RONALD GOWER. Pp. 120. *Leonardo da Vinci.* By JEAN PAUL RICHTER. Pp. 138. London: Low and Co. 1880.

OF this admirable series of popular introductions to the lives and works of those chief in renown for their excellence in pictorial art, two more volumes have been issued. One of these has been compiled by Lord Gower, of whose acquaintance with the art of the Netherlands this is by no means his first proof; the other by the inheritor of a famous name, who has treated his subject with great erudition and thoroughness. We may wonder a little that the latter has not drawn more ample illustrations of the "myriad-mindedness" of Leonardo from Dr. Grothe's essay, "Leonardo da Vinci als Ingenieur und Philosoph." And let us add a modicum of minute criticism. There is no reason for rendering "vince" on p. 42 by a past tense; and on p. 55 there is nothing to justify the expletive "as it were" in the English offered for "ad exitium Italiæ natus." Passing by these small points, however, we are glad to say that as a man, a philosopher, an artist, the reader must be dull indeed who does not get an ample idealisation from the present work of one of the greatest minds of any age. The illustrations are abundant.

Very pleasant to read or to turn over skimmingly is the volume which lets us into the humours of those realistic Dutch painters for whom, for the most part, life seems to have been so joyous. The biographies of Honthorst, Brouwer, Ostade, Dou, Wouwerman and many more, trip across the pages, brief and bright, and Lord Gower's volume is even more richly a gallery of illustration than its predecessors. The appendices of this and the foregoing volume contain very valuable matter, of the sort best shut up in such corner cupboards, it is true, but sadly missed if not given at all.

Science Primers. Introductory. By Professor HUXLEY, F.R.S. London: Macmillan and Co. Pp. 94.

THERE have been some complaints that the volume introductory to the set of valuable Science Primers now in course of publication should have been so long delayed. If we can be pardoned so Hibernian a statement, we think it would have been well to have made that introductory volume quite the last of the series. Professor Huxley would then have been in the position of the author who writes his preface instead of that of a chairman who is compelled to give by anticipation a brief chronicle of all the speeches to be spoken by the gentlemen who are grouped with him on the platform. As it is, we can only find in all some twenty pages of matter really introductory in character—that is to say, generalisations on science. There is a long account of water, as a special subject, which is excellent in itself, but an afflicting *non sequitur* where it is. It would be valuable if put forward as an illustration of scientific method, of inductive treatment, or what not, but is valueless as introductory matter. The same may be said of the short essay on biology contained in the volume. In default of the philosophising one might have expected, and the laying down of the bases of science, a map or plan of science as it exists, so far, at least, as it is intended to be covered by the Science Primers, might have been given. And, indeed, this is here and there hinted at faintly and vaguely. We will leave this little volume with a quotation from p. 85—the definition of a common fowl:—"Everybody has seen a common fowl. *It is an active creature which runs about, and sometimes flies.*"

Lett's Popular Atlas. Part III.

THE third part of this excellent and wonderfully cheap atlas has just been issued, and we are glad to learn, by an announcement from the publishers, that it is receiving a fitting meed of public appreciation. The present part contains maps of Europe, France and India, very clearly and beautifully printed from steel plates; and the coloration not only defines boundaries, but shows many physical, political and economical characteristics as well. For example, in the map of Europe the depth of the ocean and inland seas is shown in fathoms, also the population of the towns, from 100,000 to 500,000 and upwards; and in the case of Russia, the gradual extension of that encroaching empire from 1462 to the date of the Treaty of Berlin. The same hydrographical data, as in the map of Europe, are shown in that of India, together with the political divisions; and in the map of France wine-growing districts are similarly indicated, the red and white wine tracts being distinguished.

NEW BOOKS.

Applications (The) of the Physical Forces. By A. Guillemin. New edition. 8vo. Macmillan and Co.

An Elementary Treatise on the Differential Calculus. By B. Williamson. 4th edition. 8vo. Longmans and Co.

Descriptive Catalogue of the Etched Works of Francis Seymour Haden. By Sir R. W. Drake. 8vo. Macmillan and Co.

French Code (The) of Commerce. By L. Goirand. 8vo. Stevens.

Great Artists (The): Horace Vernet and Paul Delaroche. By J. R. Rees. 8vo. Low and Co.

Mathematical Formulæ for the use of Candidates Preparing for the Examinations. Edited by R. M. Milburn. 8vo. Longmans and Co.

Murby's Science Series: Principles of Agriculture. By A. Carey. 12mo. Murby.

Official Hand-Book for the National Training School of Cookery. New edition. 8vo. Chapman and Hall.

Surgeon's Pocket-Book (The): The Best Treatment of Wounded in War. By Surgeon-Major J. H. Porter. New edition square. Griffin and Co.

Shipowner's and Engineer's Guide to the Marine Engine. 8vo. Simpkin and Co.

Science Lectures for the People: Delivered in Manchester. 11th Series. 8vo. Simpkin and Co.

Theoretical and Practical Treatise on the Manufacture of Sulphuric-Acid and Alkali. By Dr. G. Lunge. Vol 2. 8vo. Van Voorst.

The Arts in the Middle Ages. By Paul Lacroix. New edition with supplement. 8vo. Bickers and Son.

BOOKS RECEIVED.

Potable Water. By Chas. Ekin. London: J. and A. Churchill.

Spon's Dictionary of Engineering. No. 11. London: E. and F. N. Spon.

Spon's Engineers and Contractors Book of Prices, 1879-80. London: Spon.

The Weather of 1879, as Observed in Neighbourhood of London. By Edward Mawley, F.M.S. London: Bemrose and Sons.

OBITUARY.

THE Right Hon. John Somerset Pakington, Lord Hampton, died on Friday afternoon last week, at his residence, 41, Eaton Square, at the advanced age of 81 years. Lord Hampton was the only son of the late Mr. Wm. Russell, of Powick Court, Worcestershire, by Elizabeth, eldest daughter of the late Sir Herbert Perrot Pakington, Bart., of Westwood. He was born on February 20th, 1799, was educated at Eton, and at Oriel College, Oxford, and in 1831 assumed the name of Pakington, as heir of his maternal uncle, the Baronet of Westwood. In 1834 he was appointed chairman of the quarter sessions for Worcestershire, of which county he was a deputy lieutenant, as well as a magistrate for Herefordshire, and was in 1837 returned to the House of Commons in the Conservative interest for Droitwich, which borough he represented till the general election of 1874, when he was defeated by Mr. Corbett, the present member. He was created a baronet in July, 1846, and was Colonial Secretary in Lord Derby's first Administration in 1852, and was sworn as Privy Councillor. In Lord Derby's second Administration in 1858-9, he was First Lord of the Admiralty; and upon the retirement of Lord Derby in 1859, the Queen conferred upon him the Grand Cross of the Bath, civil division. Sir John, appointed to his former post at the Admiralty in Lord Derby's third Administration in June, 1866, on the resignation of General Peel, succeeded him as Secretary of State for War, March 8th, 1867, and retained that office until December, 1868. On the recommendation of Mr. Disraeli he was raised to the House of Peers in March, 1874, by the title of Baron Hampton, of Hampton Lovett, and of Westwood, in the county of Worcester. At the last meeting of the Institution of Naval Architects Lord Hampton resigned the presidency of that body, which he had held for twenty-one years. His lordship was married three times, firstly in 1822, to Mary, only child of Moreton Aglionby Slaney; secondly, in 1844, to Augusta, daughter of the late Right Rev. Dr. Murray, Bishop of Rochester; and thirdly, in 1851, to Augusta, daughter of the late Thomas Champion de Crespigny, and widow of Colonel Davies, M.P., of Elmley Park. The heir to the peerage and also to the baronetcy is his lordship's only son by his first marriage, the Hon. John Slaney Pakington, M.A.

MR. WM. HUNTLEY, a pupil of George Stephenson, has just died at the age of eighty-two. In 1823 he entered the employment of Messrs. George Stephenson and Co., of Newcastle, remaining with the firm for ten years. While working with the distinguished engineer he erected the first locomotive engine that drew a passenger train, under Stephenson's personal superintendence, and Huntley had the honour of working it alternately with him on the memorable 27th of September, 1825—the first day that a train passed over the Stockton and Darlington Railway. Mr. Huntley subsequently removed to Dundee. In the year 1853 he patented a valve regulator, by which a greater amount of work was obtained out of an engine with a diminished quantity of fuel. He afterwards advocated the introduction of a continuous grip brake system, to enable drivers to pull up their engines within the length of their train.

FACTORY NOTES.

THE TIN TRADE.—Cornish smelters on Monday reduced the tin standards £2 per ton. The standards now are—superior common, 82s.; superror fine, 83s. per cwt.

ACTIVITY AT HIRWAIN IRONWORKS.—The interesting ceremony of setting one of the furnaces to work took place on Saturday morning. Another furnace is expected to be ready for blast in a few weeks.

AGRICULTURAL MACHINERY AT THE SYDNEY EXHIBITION.—We observe that Messrs. Crowley and Co. of the Kelham Ironworks, Sheffield, have carried off the first prize and the only gold medal awarded for chaff-cutters at Sydney International Exhibition. The prize for lawn mowers at the same exhibition was also gained by Messrs. Crowley and Co.

CYFARTHFA IRON WORKS.—A temporary stoppage in the rail department of these works has given rise to some uneasiness in the neighbourhood, but there is no ground for apprehensions which have arisen. The suspension is stated to be of a purely temporary character, and a few days will probably see the mills as busy again as they have been for the last two months, during which time the weekly yield of finished iron has reached about 1000 tons.

IMPORTANT CONTRACT.—Her Majesty's Government have (we learn from the *City Press*) entered into a contract with Messrs. John Mowlem and Co. for the repairs, maintenance, &c., of the Royal palaces, public building, parks, &c., of London. The contract, which is one of unusual magnitude, has reference not only to the walls and outer fabric, but to the whole interiors in every department. The buildings are to be kept in entire repair, inwardly and outwardly.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending 17th April:—On Monday, Tuesday and Saturday, free, from 10 a.m. to 10 p.m., Museum 11,482; Mercantile Marine, Building Materials, and other Collections 2212. On Wednesday, Thursday, and Friday (admission 6d.) from 10 a.m. till 6 p.m., Museum, 2054; Mercantile Marine, Building Materials, and other Collections, 87. Total 15,835. Average of corresponding week in former years, 14,848. Total from the opening of the Museum, 18,865,100.

HARDEN'S IMPROVED SECTION LINER AND CYLINDRICAL SHADER.—This instrument, which is an American invention, has just been introduced into England, by Messrs. Davis and Son of All Saints' Works, Derby, and 118, Newgate Street. It is claimed for it, that it will shade a cylinder from a quarter of an inch to four inches in diameter, whilst it will at the same time do all the work of a common section liner with great accuracy. With all this it is less than half the cost of other instruments of its character.

SPECIAL EXHIBITS AT THE AGRICULTURAL HALL.—Amongst the noticeable exhibits at the exhibition of building materials and appliances is Hart's patented brick, which is made with eight stud-like projections at the bottom, the top of each brick having corresponding indentations to receive them. This arrangement not only saves labour but also gives greater strength and durability to the structure than is obtained by the use of ordinary bricks. The Banner system of sanitation is also illustrated at Stand 39 of the same exhibition, regarding which, it may be mentioned that with a Banner cowl, smoke may be easily drawn down a 1-inch perfectly vertical tube for a length of 60 feet.

MEETING OF CREDITORS.—The first general meeting of the creditors of John Thompson, of Victoria Works, Allen Street, Sheffield, file manufacturer, was held on Wednesday afternoon, at the Registrar's Office, the County Court Hall. Mr. Registrar Wake presided. The debtor presente a statement of his affairs, which showed that his total liabilities were £6954 0s. 6d. Of this sum £2482 2s. 7d. was unsecured, £3347 4s. 8d. was partly secured, £2897 10s. 8d. the estimated value of the securities. The assets were £1872 14s. 11d., the stock-in-trade being valued at £981 14s. 11d., book debts £735, and the furniture of his house at £105. Liquidation was decided upon, and Messrs. J. Unwin Wing and J. Nell were appointed trustees. Messrs. F. R. Book, J. B. Parkin, F. Bedford, F. B. Wood and E. Turner were appointed a committee of inspection.

MACHINERY ACCIDENTS.—In a letter dated the 19th inst., Mr. C. B. Bowling, inspector of factories in Birmingham, directs attention to the fact that accidents through oiling machinery then in motion are by no means uncommon, and suggests that wherever it is possible oil-cans with long necks, similar to those used by locomotive-engine drivers, should be supplied to men in charge of the machinery in factories and mills. He cites one case of a fatal accident which occurred in Birmingham, during the previous week as an illustration of the dangers to which he alludes and says:—"A man employed to superintend the machinery in a large mill placed a ladder against a revolving shaft, and mounted it in order to oil a crank. In doing this he unnecessarily exposed himself to danger, as by moving the ladder a few feet and placing it against the wall he could easily have reached the parts to be oiled. As it was, the poor fellow's jacket caught round the shaft and he met with a frightful death."

AMERICAN GLEANINGS.

RIVER ENGINEERING.—Gen Wright, Chief of Engineers, has made a further report on the improvement of the Upper Mississippi. It appears that the reservoir will hold 56,000,000,000 cubic feet of water, available after July 1. It is estimated that at St. Paul the volume of the river would be doubled. The total cost would be $400,000; operating expenses, $7840 per annum.

SMELTING WITH ANTHRACITE.—Mr. J. J. Pierce, one of the most prominent pig-iron manufacturers in the Shenango Valley, informs the *Bulletin* of the Iron and Steel Association that for the past two months a majority of the furnaces in that section have been using one-half anthracite coal as a mixture with raw block coal and Connellsville coke He says the result has been very satisfactory both as to cost and working.

THE DISCOVERER OF THE CALIFORNIAN GOLD MINES.—The American journal *Progress* mentions that Johann Sutter, in whose fields were discovered the first Californian gold mines, finds himself, at the age of 79, in very indifferent circumstances. Sutter is now living in a Moravian colony in Pennsylvania. Though a Swiss by birth, he served till his 30th year in the French army. In 1834 he settled in Missouri. After various migrations, he came to California, where, in 1849, he discovered the first gold mine.

RESTRICTIONS OF OUTPUT.—A despatch from Pottsville, Pennsylvania, to the New York *Journal of Commerce* says that the Miners' and Labourers' County Convention, which has been in secret session here for two days, has issued to the working men a circular calling for a reorganisation of the old union for the purpose of restricting the coal production. They claim to have modified the old by-laws that worked to the detriment of the working men in the old union, and that their object is to advance the interests of labour and capital.

THE AMERICAN RAILROAD KING.—Advices recently received from Chicago state that Mr. Jay Gould now possesses a direct control over 7860 miles of railroad. The contemplated incorporation of the Missouri, Iowa and Nebraska and the Iowa Central with the Wabash Railroad would add 304 miles more, making an aggregate of 8168 miles under Mr. Gould's control. This vast mileage gives Mr. Gould and his followers direct access to the principal railroad points at the West from Utah to Ohio and Iowa to Texas. The Gould system is still imperfect, however, in that it affords no direct communication between Omaha and Chicago.

A Remarkable Plough.—A Chicago agricultural journal gives an account of the largest plough ever known to be made, which has been recently turned out by an Illinois firm of agricultural machinery makers for use on the St. Louis, Iron Mountain and Southern Railway. It is attached to a platform bar of a construction chain in such a way as to cut its ditch a sufficient distance from the railway line. It will make one mile of ditch, 2 feet deep and 3 feet wide, every four hours, thus doing the work of about 1,000 men. The beam is made of swamp oak, and is 8 inches by 4 inches, the land side being made of bar iron 8 inches wide and 1½ inch thick, which had to be forged expressly for the purpose. Its total weight is 1700 lb.

Mining Speculation in the United States.—With the general advance in American prices and increase of all kinds of business, there has appeared a mania for stock speculations in mining shares, which is much like the petroleum excitement of the war era. It is carried on in the low-priced shares of mining companies located far away in Colorado, Arizona, and the frontier regions, and has drawn into its vortex many thousands of people in the large cities. This sort of thing, once confined to San Francisco, has now spread to the Atlantic coast Stock Exchange, and so wild is the speculation, that loud warnings are already sounded by the more careful journals. The dealings in these low-priced shares are on some days enormous, and mostly by people who know nothing practically about what they are buying. "Mining Boards" have been organised in all the chief cities, where these stocks are dealt in exclusively; and they also appear in large amounts on the regular Stock Exchanges.

Fast Work in a Car Shop.—As an exhibition of rapid work, the result of last week's business at the car shops of the Consolidated (New York, New Haven and Hartford) Road in this city furnishes an almost incredible instance. From 7 a.m. Monday, the 15th inst., to Saturday noon there were constructed 100 eight-wheeled coal cars, with a capacity of 18 tons each, which were finished at the following rate each day:—Monday, fourteen; Tuesday, eighteen; Wednesday, nineteen; Thursday, twenty; Friday, eighteen; Saturday, eleven. The work was performed under the personal supervision of Mr. Loren Packard, the efficient master carbuilder, to whose energy and ability may be ascribed the successful completion of the work. After such an extraordinary week's work the force of the shops will take it comparatively easy this week. Next week it is proposed to put up 160 six or seven-ton coal dump-cars, and these will be followed probably by the building of 200 box-cars.—*Hartford Courant.*

The Labour Market.—At a special meeting of the South Staffordshire Wages Board, held at Birmingham on Tuesday afternoon, to consider the application of the operatives for an advance of wages, the President (Mr. J. Chamberlain, M.P.) stated that owing to the increasing burden of his Parliamentary duties, he must resign his position as arbitrator. He advocated the union of the iron trade under one board. At the request of the meeting, Mr. Chamberlain proceeded to confer with the masters and operatives with a view of establishing a sliding scale. On Monday morning upwards of 200 men had to leave off work at the Moor Iron Works, Stockton, in consequence of a dispute between the rail mill furnacemen and the employers, the former having applied for an advance of wages. The action of these men, numbering about twelve, is looked upon with considerable displeasure by the large number who are thrown out of employment. At a meeting of the frame-turners' helpers now on strike, which was held on Monday morning at the Globe Inn, High Street, Sunderland, it was intimated that Messrs. Doxford's frame-turners had offered their helpers an advance of 2s. 6d. per week in wages if they would return to work (to complete contracts now in hand) on the old system of "day's wages" or "time" work. As the men of all the yards affected by the strike have agreed to act in concert, the offer was placed before the meeting, with the result that it was rejected, and a resolution carried reaffirming the men's determination to stand out for piece-work. On Saturday the furnacemen, fillers, and labourers employed at Summerlee Ironworks struck against the reduction of wages which had been intimated to them a fortnight before. The reduction would be equal to 8d. or 9d., and, in some cases, 1s. per day. The men offered to resume work on the same terms as those presently obtained by the men at Gartsherrie and Newmains. No answer being given, they continue out, and Summerlee Works are completely idle—the whole six furnaces being meanwhile off blast. On Monday the whole of the men—about 300 in number—who have been out on strike for the last three weeks at Tannochside Collieries, belonging to the Monkland Iron and Coal Company, returned to their work on the masters' terms, which will entail a reduction of about 1s. per day upon the ordinary output. The miners in the employ of the Hodbarrow Mining Company, near Barrow, have received an advance in wages, the underground men receiving 10 per cent., and the top men 5 per cent. The miners of South Hatton and Murton Colliery, numbering upwards of 900, this week received notice from Mr. Forster, the head manager, that their wages will be reduced 17½ per cent. The miners have determined to come out on strike against it. The miners employed by the Benhar Coal Company have been reduced in their wages to the extent of 1s. per day, in consequence of which the men have left off work, and are determined to resist the reduction, and are willing to come to terms if the masters only make a reduction of 6d. per day.—The men employed in Calderhead Collieries have also been reduced to the same extent. A notice has been posted on the works gate notifying the men that a general reduction will take place on the 24th of this month, by order of the directors. A meeting of the Glasgow coal masters was held this week, when it was resolved that an immediate reduction of 1s. per day should take place in the wages of the miners; in the other districts a reduction of 6d. per day has already taken effect. The masters are acting independently at present, and there is no disposition on the part of the men to oppose the reduction.

IRON AND COAL TRADE REPORTS.

BARNSLEY AND SOUTH YORKSHIRE.—The reports which continue to be received respecting the state of the iron trade, are not over cheering. Some of the foundries are not over well off for orders, but in some other branches a more satisfactory state of things prevails, although no branch connected with the output of manufactured iron is over brisk. The make of pig-iron is fully sustained; the four furnaces at Elsecar, two at Milton, two at Thorncliffe, are kept fully going, and are yielding a large output weekly. Those at Parkgate and other places in the district are also in full blast. The Wortley Iron Works, which are for the most part devoted to the production of railway material, are doing a fair stroke of business, as are also the Yorkshire Steel and Iron Works, Penistone, where a good deal of Bessemer steel tires, rails and axles are turned out. There is no improvement in the coal trade, and so far as the demand for London is concerned the district coalowners declare they are being virtually compelled to abandon the London market, the tonnage rate being from 1s. to. 1s. 1d. per ton more than from some parts of the Derbyshire and Nottinghamshire coalfield. Respecting the rates it may be stated that arrangements have been made for holding a demonstration of miners and others at Mexborough on Monday afternoon to protest against the present rates, and to further the proposed new Hull and Barnsley Railway in connection with the promotion of which a deputation will attend from Hull. The business done with the eastern counties has been very quiet for some time, but on Wednesday one of the largest firms in the district gave orders for their waggons to be promptly dispatched from the whole of the South Yorkshire collieries. The steam-coal trade is somewhat better, but the demand will not be large until the Baltic ports are properly opened. The tonnage to Hull and Grimsby is increasing, and it is satisfactory to note that the exports from both places last week showed an increase. With the exception of Lundhill, Earl Fitzwilliam's, and a few other collieries, in the district, the pits are not making more than three and four days per week. There is a rather better chance for small coal and slack for engine purposes, at prices which it is true are very low. The coke trade is not so active, yet the means of production are being extended on every hand, and it is questionable whether purchasers are not fast "killing the goose that laid the golden eggs." The extension of collieries and the opening out of new ones proceeds but slowly. The new owners of the Fitzwilliam Hemsworth Main Colliery are pushing on with the work of extending their operations. The underground haulage engines are being repaired, and the whole of the plant is being put into an efficient state of repair. The labour market is being agitated by the officials of the Old South Yorkshire Miners' Association, who have been holding meetings in various parts of the district to induce the men to rejoin the union. Judging from the attendance and the response given to their invitation, they have effected but little. Owing to the breaking of the main shaft of the ventilating fan, coal-getting at the Barrow colliery has had to be suspended, or nearly so, and a large number of men are out of work. At Monk Bretton the pit is still worked by non-unionists, but the old hands are doing all they can to induce them to leave the district.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—No change of any practical moment can be noted in the condition of the hematite pig-iron trade. For two or three months past very little business has been done, and the parcels which have changed hands have been mainly those held by second-hand dealers, who have been willing to sell at lower values, in order to clear out. There is only a comparatively small tonnage of second-hand iron in hand, and makers seem to think so soon as this is disposed of there will be a check to the downward tendency of the market, inasmuch as they have sufficient work in hand to maintain activity for a greater part of the present year. On the other hand, it must be remembered that the market is presenting every indication of being fully supplied for the present. The requirements of America have been satisfied, and there are not many inquiries from that quarter. The demand is also quiet on both home and Continental account, although several inquiries have lately been made for terms of future deliveries. The downward tendency in prices, however, will no doubt have the effect of inducing a better demand, and in the best-informed circles it is generally believed that the market, in the course of a few weeks, will show a steady tone, and that a basis of commercial confidence will be established, on which a good and sound trade can be done in the future. Bessemer qualities of iron have been quoted this week at less than £5 per ton, being a reduction of 30s. in three months. Stocks do not exist to any extent, for during the past six months heavy parcels of iron have been disposed of, and stocks thereby reduced, and in many cases absolutely cleared out. There is not as good a demand for steel as of late, but the rail mills and merchant mills are fully employed, and are likely to continue so. Iron ore is quiet in tone, but large deliveries are being made to the works in the district and elsewhere, and prices show no material change. The coal and coke trades are very steadily employed. Shipping, especially at Barrow, is very brisk, and large exports of metal are being made.

BIRMINGHAM.—In sympathy with the weakness in the local iron markets, which was very distinctly indicated on 'Change last week, a similar tone has prevailed in most branches of manufacture, and the prices of iron tubes, nails, brass and copper wire, sheets and other articles, show a fall as compared with quotations prior to the Easter holidays. Business has now got into full swing again all round; but there is a general complaint of want of animation in trade, orders alike for home and export coming in but slowly and falling short in volume of the season's average. In several branches the unsatisfactory character of the orders received by the latest mail from the Australian colonies and New Zealand created some uneasiness, but the accompanying advices spoke so hopefully of prospects in the latter colony in the immediate future, that so far as that market is concerned merchants are looking forward to a very gratifying recovery at an early date. From Sydney, it is true, the look-out just for the present is not nearly so encouraging, the consumptive demand being reported dull in the extreme. Stocks more than equal to any possible recovery at an early date, and prices low and weak. Still this state of things is felt to be only temporary, and hopes are entertained that the depression will not be long continued. In the American demand there is a decided lull, which is all the more severely felt because of the exceptional activity which has characterised the local hardware trade with the States for some months past. Gunmakers, however, continue for the present fully employed on cheap sporting guns, which are being tureed out here in considerable numbers to supply an active American demand. At the prices at which by far the larger proportion of orders for these goods have been booked, manufacturers have had only an extremely limited margin of profit, and as gunmakers in the States have already commenced turning out cheap machine-made guns the competition will probably become even more severe. Local sewing-machine manufacturers are in daily expectation of further orders from America, in the absence of which, owing to slackness in both the home and export trade for some months past, the leading firms are unable to keep their works going full time. Shipments of galvanised iron, edge-tools, tin-plate goods and electro-plated ware have been fairly brisk for the South American markets, and a good trade has recently been done in most branches of local industry with the South African colonies, the demand from Natal being specially noticeable. For India orders have not been numerous or extensive, and have been mainly confined to railway material and machinery. Lamp-stone makers have prepared some very useful and attractive patterns, and, notwithstanding the keenness of the competition with German houses in the export trade, expect shortly, as the season advances, to experience something like the activity which characterised this branch of trade last year. The home trade continues dull, although in some departments travellers' orders show a slight improvement on those for the previous week. There is a better request in the metropolis, and the larger towns in Lancashire and Yorkshire with a greater disposition to buy in the country districts, but the general trade in the North of England has fallen off somewhat. Builders' ironmongery is in improved demand, but the purchases made are of very limited extent. Prices favour buyers without quotable variation. The local iron trade has on the whole been languid, and manufacturers complain a good deal of their inability to obtain specifications from buyers to place their orders at the commencement of the year. The leading makers have been fairly busy on plain and galvanised sheets for the South American markets, nail-rods for India and China, fencing-rods for the Australian colonies, and hoop iron for America, as well as on sheets and plates of the very best quality for shipbuilding purposes. Amongst the leading lines in the home trade have been strips for gas and water tubing, foundry pig for water mains and hollow ware, and angle and hoop-iron for metallic bedstead makers, but in all classes the orders are below the season's average, although there has been a quotable fall in pig-iron, the actual net prices are from 5s. to 7s. 6d. under the standard of £4 10s. for native hot-blast all mine with a similar range as regards other descriptions. Wednesday's market at Wolverhampton was one of the dullest for months past; few orders were given out, and buyers could not be induced to make forward purchases even at reduced prices. Some of the smelters are already talking of curtailing production, and one firm has already blown out one of the furnaces. The want of specifications was the chorus of complaint among finished-iron makers. An exception to the prevalent inactivity is to be found in the case of the Patent Shaft and Axletree Company, who are said to be busier than ever.

Thursday Evening.—Business on 'Change to-day remarkably quiet in all branches and orders on hand are rapidly being worked out. In export trade America has been taking large quantities of hoop iron, while some good shipments of galvanised sheets have been made to Australia and South America; India and China have also taken supplies of nail rods on fair scale. Local demand very limited. Market somewhat unsettled by wages arbitration, but impression is general that no material difference in cost of production will be made by the new scale.

CARDIFF.—Notwithstanding that the decline in the price of iron has been attributed to over-production, the ironmasters of South Wales are still moving in the direction of an increased make. At the Rhymney Ironworks and at Cyfarthfa the lighting of new furnaces is progressing; and, in addition, there has been a resurrection of the long-defunct Hirwain Ironworks. The Marquis of Bute is said to be one of the contributors to the new concern, which is called "The Stuart Steel, Iron and Tinplate Company (Limited)." There is evident confidence in the future of the trade; and prices, if lower, must bear—both at present and prospectively—a margin that will remunerate the manufacturer. If this is not the case, then increased production, in the face of a weaker demand, must be on the principle of "the fewer the fish, the wider the net." Large transactions in foreign ores are taking place at the lower figures. The steam-coal trade continues to employ the collieries unusually well. The shipments are increasing weekly, and in many directions extra hands could be engaged; but prices are practically unaltered since February last.

CLEVELAND.—The iron market has become more and more depressed. On Tuesday, parcels of No. 3 were bought at 42s., and the tendency is still downward. In point of fact there is quite a panic, especially amongst weak holders. Buyers are holding off, expecting lower prices. It is firmly believed by not a few, however, that the decline is only temporary, that the statements as to overproduction are exaggerated, and that prices will shortly run up as quickly as they have run down. Forge iron still fetches as high a price as foundry. The finished-iron trade is not so promising now as it was some time ago. Inquiries are not so numerous, and old orders are being completed without the prospect of new ones to go on with. At our large works some of the men are under notice of discharge for want of orders. In the lighter kinds of manufacture the trade is better and the prospect not so discouraging. Angles and bars £7 5s., plates £8 5s. to £8 10s., puddled bars £5, rails £7 5s. to £7 15s. There is a very slight improvement in the coal trade. Steam-coal 8s. 6d. to

8s. 9d., less the usual discount. Coke rather easier, 14s. to 15s. General business rather depressed.

DERBYSHIRE.—The make of pig-iron throughout the district has of late been considerably increased, and at the present time the output is large. The Butterley Iron Company have two furnaces in blast at their works near Alferton, and a similar number at Codnor Park. When the return for the mineral statistics for 1878 was compiled the Erewash Valley Iron Company had only one out of their four furnaces in blast, but at the present time they have three in full work out of the four they own. The two furnaces connected with the Oakerthorpe Collieries, near Wingfield, formerly owned by Messrs. G. Pearson and Co., are being put into a thorough state of repair, and will be blown in towards the close of next month by the Dodworth and Silkstone Coal and Iron Company, who, it may be stated, will supply all their own coal and coke from their Yorkshiree Works. The foundries, all things considered, are doing very well, particularly those engaged in the production of gas and water pipes. The Butterley Iron Company have just completed a contract for pipes for the Ripley Local Board, who have constructed new waterworks to supply the town with water. The engines and boilers required for pumping purposes have been made by Messrs. Thornewell and Warham, of Burton-on-Trent. The coal trade is not so good as it was a short time ago. Some of the pits in the Erewash Valley district are not making more than three or four days per week, and even at this rate of working stocks are accumulating at the collieries. The pits in the Clay Cross and Staveley districts are better off, having placed some large contracts at low prices. The London trade is said to be quieter, owing in some measure to the large output and the seaborne coal which is imported into the metropolis. There is no change to note in the steam-coal trade, but some improvement is expected when the export season fairly sets in. Other kinds of coal meet but an indifferent sale, but the demand for coke holds pretty well up. Notwithstanding the quiet state of the coal trade the sinking of a new colliery has been commenced at Pentrech, near Ripley, the coal lying at a depth of about 260 yards below the surface.

DURHAM.—The iron trade has been in a very disturbed condition. Suddenly, as it were, within a week, consumers of pig-iron find that they can buy pig-metal from secondhand holders at 8s. per ton below what they were at the early part of last week. There is no apparent reason for this large drop except the fears of speculators. They had built on the American trade keeping up; instead of that it is thought it will give way under the influx of crude iron imported from England and Scotland. It is true that a considerable quantity of iron is still being sent from the north of England to America; 1250 tons were shipped in one day this week from the Tees for America, and 2500 tons in one day last week. Probably this is because the American consumers who bought it some time since find it more profitable to take this iron than to return it on the home market, especially in the desperately-low condition of prices which now prevail. Many in the trade fear that there will be an excess of pig-iron ere long, and therefore the prices are not likely to again rise, at least for a time, as they did early in the year. No. 3 has this week been offered at 42s. and even less. The manufactured iron trade has shown a quiet condition, though in no sense so bad as the pig-iron trade. Prices, however, are weaker. Bars are about £7 5s., angles £7 5s. to £7 7s. 6d.; iron rails £7 5s. to £7 10s., ship plates £8 5s., less 2½ per cent., puddled bars £5 net. There has been little or no visible effect produced on the works in operation in the district. They seem to be all fairly employed. It is, however, feared that some of them will soon fall short of orders. The Consett Iron Company have work, it is stated, taken at the late high rates, to last through the year. There have been some violent flustuations in the value of some of the local iron and coal shares. In one instance the movement up and down has been remarkable. It is probably largely due to speculative causes. A natural tendency to decline is, however, apparent in nearly all share property of this description. The household coal trade has been rather better, about 6d. per ton more having been obtained in some cases for shipment. In the rates of mannfacturing coal there has been no change. The tendency of steam-coal has been downwards, and the same is the case with coke.

FOREST OF DEAN.—There is continued improvement in the house-coal of the Cinderford Valley, and the pits there are once again more fully occupied than they have been for several months. Taking the first quarter of 1880, the output will be smaller than remembered for many years, as, with hardly an exception, pits have not exceeded an average of four days per week. Now the prices are more approximate with other and competing districts. Merchants are sending their orders to the Forest, and the trade is improved both by rail and river. In the western part of the Forest there is no restart at the Parkend pits, hence the employes and the firm are still idle. Anent the question of the Forest coal and iron ore trades, Mr. Nicholson, a venerable gentleman acquainted with the mineral deposits of the district, and commercial matters as well as most men, has recently addressed a numerous gathering of the unemployed men, and given a gloomy picture of local affairs, by stating that the upper measures of Dean Forest will be won in the course of thirty years, and unless the Crown promotes a general system of drainage the Forest, as a coal and iron field, will be shut up; that the deep measure — Coleford high deff — can only be got by the drainage referred to, and which, if up to the mark of expectation, would give a further three hundred years' lease of life to the district as a coal and iron field. Substantially this is accepted, and the assertion has been made to the Hon. I. K. Howard, the chief commissioner of Dean Forest. It may be remembered that in the eastern valley the late Mr. Crawshay commenced, and his sons are carrying on, operations for the acquisition of an extended pumping station, so as to enable the firm to win a deeper area of iron ore from their Buckshaft and other mines. Notwithstanding the reverse in the iron trade continues, belief prevails here that it can only be of a temporary character, and that the "situation" is the result of high prices and indiscreet speculation. There is no abatement in the local output, Messrs. Crawshay continuing their three furnaces in blast. Stocks are rather heavy. The demand for iron ore is maintained, at least there is an active sale of best classes of local ores. Since the turn of trade last summer there has been a large get of local ores. Stocks also in several instances having disappeared. At the tinplate manufactories trade is rather brisk, and in some cases overtime is made by the employés. There is no move in the building industries, which continue paralysed, and it is feared will remain so until there is a general and permanent revival in the staple industries.

GLASGOW.—The weakness in the warrant market has become further intensified, many holders have shown the utmost anxiety to get quit of their iron, and, buyers being scarce, reduced prices had daily to be submitted to. The merchants and brokers seem all disposed to take a despondent view of the situation, and 45s. is openly talked of as being a point likely to be reached very soon. The demand for iron shipment has entirely fallen off, and it is reported that New York steamers are willing to carry pig iron at almost ballast rates, though last week 3820 tons went to America and 3650 tons direct to Canada, but these were bought some time ago. The Continental demand is very quiet, and the reduced price of Middlesborough iron will now admit of larger quantities being sent to Scotland, so that, present prospects are not at all encouraging. On Thursday the market was quiet at 52s. 3d. to 51s. 9d. cash, and 52s. 6d. to 52s. a month, rallying next day to 52s. 6d. cash to 52s. 9d. a month. On Monday the price fluctuated between 52s. 9d. cash and 53s. a month and 51s. cash and 51s. 3d. a month, next day down to 50s. 3d. cash and 50s. 4½d. a month was accepted. On Wednesday a large business was done from 50s. 2d. to 48s. 6d. cash. Closing buyers 48s. 7½d. cash and 48s. 10½d. a month. Sellers 1½d. per ton more. Makers have made considerable reductions in their prices, but are still being undersold by merchants. There are now 115 furnaces in blast, against eighty-seven at this time last year. The shipment of pig-iron from Scotland last week were foreign 11,481 tons, coastwise 4313 tons, total 15,794 tons against 13,228 tons in the corresponding period of last year. The imports of Middlesborough pig-iron into Grangemouth last week were 2575 tons against 3595 tons in the similar period of last year. The total imports till April 17th 1880, are 69,590 tons against 79,707 tons till April 19th, 1879, showing a decrease for this year of 10,117 tons. Iron is now going out of Connal's store. The stock there is now 436,835 tons, a decrease for the week of 1573 tons. The manufactured iron trade is again falling into a dull condition, buyers are holding back their orders if they have got any at all. Many of the works are now unable to keep their mills running full, notwithstanding that prices have been officially reduced another £1 per ton, making a fall of £2 per ton from the top. Common bars are now quoted at £7 to £7 10s., shipplates, £8 10s. to £9; boiler plates, £9 to £9 10s., nail rods, £7 10s. per ton less 5 per cent discount, but good specifications might be placed on more favourable terms. The exports last week were again small the chief items being for the Continent wrought-iron goods valued at £3605, sewing machines at £3519; for Trinidad galvanise; iron at £2804 and for Honolulu machinery valued at £2455. The engineering and shipbuilding industries are again relapsing into a state of depression, no new orders of any consequence are being given out though it is believed that as soon as the market begins to steady, many projects which the high prices kept in abeyance, will be once more be pushed on. The coal trade is without any signs of improvement; in most districts the colliers are receiving notice of a reduction in wages, which they are not likely seriously to resist.

LANCASHIRE.—In the iron trade of this district, business during the past week has been in a most depressed condition. There has been an almost entire absence of demand, with very little enquiry for any description of iron. The unfavourable reports from other markets, and particularly Glasgow and Middlesborough have naturally had a very considerable effect here, with the result that prices have been forced down with a rapidity which could scarcely have been anticipated a few weeks back. Indeed, the sudden revulsion in the market has taken every one by surprise, and so completely shaken confidence that buyers refuse to give out further orders at present, and local consumers, who are generally tolerably well supplied with iron, are working on their stocks. Of course the hope is entertained that the present collapse of the market may only be temporary, as the indications with regard to requirements, both for home and foreign consumption, were generally held to encourage the hope of a fair trade being done, but until it is seen that the downward movement in prices has been arrested, it can scarcely be expected that there will be any large amount of buying, and at present there is a belief that prices have not yet touched their lowest point. Lancashire makers of pig-iron, who prefer to work on with the orders they have yet on their books, which will generally carry them over quite another month, rather than attempt to meet the market at present, have practically withdrawn their quotations, although they would be open to offers; but 62s. 6d. per ton, less 2½ per cent., may be given as about the price for Lancashire foundry and forge iron delivered into the Manchester, and for good orders less money would be taken. So far as outside brands are concerned, it is difficult to get at any really reliable price, as holders of second-hand iron, anxious to realise, are quoting such widely different figures, which seem to be altogether governed by the position of the seller. Middlesborough iron has been quoted as low as 50s. 4d. per ton net cash, delivered equal to Manchester, and second-hand parcels of Lincolnshire could be bought at about 60s. per ton, less 2½; but makers' prices, as a rule, are little more than nominal, as they are not competing with the dealers, although there is no doubt that if they had to seek orders they would have to come down very considerably upon their present prices. In the finished-iron trade there is a continued downward movement in prices, although not to the extent as in pig-iron. Good bars delivered into the Manchester district are quoted at about £8 per ton, but there are plenty of second-hand lots which could be bought at full 5s. per ton under their figure. Forge proprietors, as a rule, are still fairly supplied with work, and there are very few cases in which they are actually pressing for orders. With regard to founders, engineers, and machinists, there is no material change to notice; generally they are in a better position than they were some nine months ago, but the improvement has still been only small, and from most of the Lancashire districts trade is reported as bad. The coal trade continues dull, all descriptions of round coal being bad to move, with short time very general throughout Lancashire, and heavy stocks for the time of the year held at most of the collieries. There is a good deal of underselling to secure orders, but the quoted prices at the pit mouth remain at about 8s. to 8s. 6d. for best coal, 6s. to 6s. 6d. per seconds, and 5s. to 5s. 6d. for common. Engine fuel continues in good demand, with a hardening tendency in price, good burgy at the pit being quoted at 4s. 3d. to 4s. 6d., and good slack 3s. 6d. to 4s. For shipment there has been a rather better demand, but low prices as a rule have still to be taken.

LEEDS AND WEST YORKSHIRE.—Since last week there has been scarcely any change in any phase or branch of the iron trade here and hereabouts. Work at the forges keeps steady; that is to say, those forges working hitherto two-thirds time (and these are chiefly the best Yorkshire iron makers) keep doing so still; while at such places as Lowmoor, where there is a demand, so to speak, from all nations for their matchless brand, and at Monk Bridge Ironworks, where the manufacture of both best and common iron are combined, there is literally no end of work turned out. Undoubtedly, the quantity of best Yorkshire manufactured iron now being dispersed from this town and neighbourhood to various British, Indian and Colonial centres, is four-fold what it was six months ago. There is room for much more expansion, and no one seems to entertain any doubt that it will come in time. For instance, there is not anything like the quantity or variety of rail work given out that it was expected there by this time would be. Mostly the tires and axles which have left the Leeds forges have been for abroad. The home railways have yet to give in extensive orders, and before long the best Yorkshire iron masters will be sure to find their hands almost overwhelmingly full in that department. Some of them do not seem to be making preparations for such a pressure, although they feel it to be inevitable; have nothing like such stocks of puddled iron before hand as one would have supposed prudent management would have required. The crucible steel manufacture of this district is very fluctuating in its extent, and what there is of it, arises principally from engineers' and machinists' special requirements. The common iron trade is brisk, as far as regards sheets, bars and angles, and merchants are trying to do a safe rather than a speculative business. The consumers of Scotch and Cleveland pig-iron are well supplied for some time to come; and in one or two instances, the stocks are immense, which have been acquired under most favourable circumstances. Locomotive engine makers are fairly employed on old orders. In one or two quarters there are sanguine anticipations of important fresh orders at no very distant date. Some firms reckon themselves well off, because now they can find a tolerably good, but not quite constant, work for a limited number of men, whereas, not so very long ago, they were almost positively in a state of destitution, as regards work. The condition of the special tool and machine shops is as before reported, but nail-making is a brisker business than usual, tons upon tons being regularly forwarded to foreign parts. The North Yorkshire coal trade keeps steady at the low point of output and consumption, which for so long a period we have had uninterruptedly to report. There is no change in prices, which are considered to be at a minimum.

LONDON.—We have no improvement to notice in the metal; on the contrary, a still further decline is noticed in most metals. Scotch pig-iron only realises at the moment 48s. 6d. for warrants and very little business. We cannot but believe that the present reaction from prices ruling at the beginning of the year, is but temporary. The position of most metals is exceedingly good and the consumption continues great, and, although works are making largely, still stocks are decreasing. In copper we have no new feature to notice beyond a further decline. Chili bars £59. Tin also is easier; Straits and Australian £79 to £79 10s., closing, however, firm at three figures. Lead flat, with not much business.

NEWCASTLE AND THE TYNE DISTRICT.—Amongst all classes of business people in this locality the chief topic of conversation during the past seven or eight days has been the highly-sensational movements in the iron market, which have almost thrown into the shade the speculation as to the probable *personnel* of the incoming Ministry. Since the rapid and enormous rise in the prices of pig-iron that took place in October last there has been no such surprise. Last week we said No. 3 had come as low as 50s., and now it can be had for 42s. per ton. It cannot but be said that the market is in a somewhat anomalous position, for whilst in October stocks were increasing the prices went up in bounds, and at the present time, when stocks are on the decrease, the value of the article is daily lessened. No doubt much of the panic that has seized speculators is due to the apprehension, which is apparently well founded, that American shipments will decline, and to the rashness of the Scotch brokers in forcing heavy stocks on the market. However, there is a settled feeling here amongst practical men that in the course of a few months, when the ill effects of over-speculation shall have passed away, the iron trade will again be in a healthy state. No. 4 forge is offered at 43s. 6d. by some merchants, but makers, few of whom will quote a price at all for any sort, ask nothing less than 51s., and for No. 3, 50s. Manufactured iron has also been affected, but not to such an alarming extent. Middlemen have been holding iron and steel rails and other finished articles in expectation of a rise, and are now selling at a loss; but with the present consumption manufacturers are confident of the future. Bars sell here at £7 7s. 6d.; angles, £7 7s. 6d. to £7 10s.; ship plates, £8 7s. 6d. to £8 10s., less the usual commission. The Tyne shipbuilders work up the iron as fast as they can get it, and everything points to a continuance of this satisfactory state of things over the summer and autumn months. Messrs. C. Mitchell and Co. have two large steamers approaching completion at their yard at Low Walker, and they are laying keels for other two. They have also several fine vessels in the intermediate stages. From the opposite side of the river Messrs. A. Leslie and Co. have just completed a large new steamer for a Liverpool firm to trade between this country and South America. She is said to be a very fine specimen of Tyneside work. In all the other establishments of the kind work is being pushed forward with all energy, and in the yards of Shields there is a fair amount of repairing in hand in addition to the building of new vessels. Our engine manufactories have orders that will keep them active for a considerable time. Boiler works also are doing well, and forges continue full of heavy work. Indeed, the shipbuilders cannot get forgings done so quickly as they require them, and sometimes much inconvenience arises in this way. The coal trade is very steady this week, the Baltic trade having fairly opened. Steam coals nominally maintain 10s. per ton value, to which they were advanced on the 1st of the month, but considerable concessions are made to purchasers who have ships ready to receive cargo, and consequently 9s. 6d. may be said to be about the correct value of the better descriptions on the spot; but forward contracts are cautiously entered into by coalowners at 10s. to 10s. 6d. per ton. For gas and manufacturing coals there is a good demand, and the shipments of blacksmith's small have improved since the opening of the Baltic. There is also a better inquiry for house-coals, but prices remain unchanged. Prices in the chemical trade are weaker, very few orders having been received of late, and merchants show but little disposition to buy. Manufacturers are, however, showing no signs of curtailing the make, as stocks are by no means large. The quotations for present shipment are:—Soda ash, 48 to 52 per cent., 1½d. net; refined alkali, 52 per cent., 2d. less 2½ per cent.; bleaching powder, £6 7s. 6d. net; soda crystals, £3 5s.; bicarbonate of soda, £9 12s. 6d. Cement works maintain a fair briskness. The large copper works on our river are also very active. Firebricks and other fireclay goods are being shipped in great quantity, chiefly for the Continent, and a rise in prices seems not improbable. The quoted price of Cowen's and Ramsay's bricks remains at 50s. per thousand; but other makers of less standing are advancing their prices to within 2s. 6d. of that figure, which is less than the usual difference by one-half. The Walbottle Firebrick Works have orders on hand, at 45s., sufficient to keep them going for two months to come, mostly for export, and decline orders unless they are at 47s. 6d.

NORTH STAFFORDSHIRE.—Trade prospects in this locality are not very promising just at present. The orders booked during the recent revival are being worked off, and very few others are coming in to take their places. Some of the works are fairly employed, but the majority are on reduced time. There is less confidence in a return of the American demand, and an increasing notion that the large business lately done by that country was more of a speculative character than was formerly supposed. The home market continues dull, and can hardly improve now until the fall, and then it will depend upon the harvest. If that is good farmers will have the heart to buy implements which they want now but cannot afford to acquire. A good many merchants took advantage of the late spurt in trade to lay in stocks of general iron, and they will not require further additions for some time to come. The demand for Australia is better, and there are a few Russian orders placed in the district, but these combined do not make an appreciable difference in the amount of business done. There is one circumstance, however, which affords a gleam of comfort, and that is that in a fair proportion of the contracts lately booked North Staffordshire brands were specified, showing that the products of this district are rising in estimation, being placed on a level in some cases with much more expensive special brands produced in South Staffordshire. Prices are not so firm, consequent on the underselling going on and the fierce competition of other districts. The sale of pig-iron has fallen off, and rates are weaker. Ironstone is in a similar condition. The coal trade shows no signs of improvement.

NOTTINGHAMSHIRE.—Although the local trade bears a quieter aspect, the collieries in this district are doing a fair business in house-coal, and some of them enjoying a much less tonnage rate than the pits in South Yorkshire, and even some parts of Derbyshire are sending a good quantity to London. For some time the differential rate between South Yorkshire and Derbyshire, was 8d. per ton, Staveley being taken as the centre of the latter district. Of late years, owing to the opening out of the collieries in this and other districts as near or near the metropolis, the rate has been reduced, and some of the pits are now paying only 7s. 3d. per ton, being 1s. 1d. per ton below that charged from pits in the Mexborough and other districts of South Yorkshire. This is having the effect of revolutionising the trade. Some of the collieries in the district adjoining Nottingham are only poorly off for orders, while the Kilburn collieries are working short time. There is a fair demand for gas-coal, the requirements of the works in the Midland Counties being pretty large. Cobbles are in better request than most other kinds of coal. There is not over much doing in steam qualities, but as the season advances this class of fuel will doubtless improve. The demand for small coal and slack varies, there being a fair sale at some collieries, whilst at others what is raised is to a great extent thrown down or stacked at the pit banks. Locomotive coal is for the most part supplied to consumers in accordance with contracts entered into at low rates some time ago. The Midland and Great Northern Railway Companies are drawing largely from some of the pits in the Mansfield district. The iron trade presents a somewhat quieter aspect than it showed a short time ago. The number of furnaces in blast at the present time will shortly be increased by additional ones. The Stanton Ironworks, near Nottingham, have now seven in blast and one out, whilst in 1878 and for some time previously they had only five at work, whilst Messrs. Oakes and Co. have all three furnaces in operation.

SHEFFIELD.—Business during the past week in all departments has been drooping, and there is an absence of that energy which was characteristic of the revival a few months ago. The Bessemer department has been specially affected, and qualities quoted at £10 in the ingot three months since are offered at £9. It is believed that this is only a slight reaction consequent on over-buying when the rush came which sent rates from £6 to £11. There are large orders on hand for rails, tires, and all classes of railway material; but these are mostly on account of old contracts, and had not some of the houses brought stocks of iron forward, would now have to be executed at a dead loss. Those who had contracted with the large makers for scrap-rail ends, &c., are clearing well, as there is a fair demand for this line. The iron market is dull, and the tendency of prices is rather downward, consequent on reports from the north of England. Derbyshire smelters are doing a good trade, and the market movements do not affect them much, as most of them have contracts which relieve them of their output. We notice that at the foundries there is more activity, and large orders are to hand for heavy mains, pipes, and castings of this description. The advances of late in the price of the raw material have, however, checked business. The armour-plate department is much busier. Late experiments with the composite plates have been of a very satisfactory character, and it is expected that before long all the mills will be running full time. Coal has risen 1s. per ton during the past month, but is cheap, and in full supply at the following rates on the wharves:—Best branch, 13s. 6d.; picked Silkstone, 11s.; Silkstone house, 10s. to 10s. 6d.; nuts, 7s. 6d. to 8s.; slack, 4s. 6d. to 5s. The advances in the price of coke will compel steel-manufacturers to advance their rates; and from this cause alone converters of Bessemer must again advance their rates. Coke:—Local made, on Sheffield station sidings, 21s. to 22s.; North-country, 28s. to 29s. Manufacturers, as a rule, are complaining much. Though large orders come in for cutlery, it is with the greatest difficulty the average advances in prices can be secured. Yet steel, bone, ebony, ivory and pearl have within three months, advanced 50 per cent. in value. The orders coming in are mostly for the Colonies and South and West Africa. It is hoped that, notwithstanding the adverse duties on goods sent into Spain, the trade will in a measure be recovered; and there are symptoms of a revival in that direction. The file trade is exceedingly brisk, and almost all the hands in it have secured an advance of wages; though in some departments the concession is not to take effect until next month. Electro-plate and Britannia-metal manufacturers report business improving.

SOUTH STAFFORDSHIRE.—The attitude of the home market, as regards the buying of hardwares at the presrnt time, is one of waiting in anticipation of lower prices. The easier tendency of the iron market has put consumers of hardware upon a better footing, and they are making the most of their opportunity. Manufacturers anxious to do all the business possible have here and there advised specific declines in prices, but more generally where lower rates are accepted it is the result of special negotiations. The foreign trade still shows the most improvement, and advices from certain of the leading markets speak encouragingly of the prospects for South Staffordshire manufactures. Australia, New Zealand, India, and the Cape are included in this category. The bicycle trade is flourishing just now in Wolverhampton, and the capacity of manufacture is greater this season than ever before. Home and foreign orders are alike being executed in large numbers. The hollow ware makers are more active than of late, and enamelled culinary and dairy utensils are in steady sale. The makers of heavy hollow ware and of light ironfoundry goods are complaining much of disadvantage which they stand at as compared with their competitors in Scotland in particular, on account of the heavy railway freights from this district to the ports. The Bilston fry-pan makers, tray and waiter manufacturers, and general deep stampers are only quietly engaged. The iron trade is without much spirit either in raw or finished iron.

WEST CUMBERLAND.—There is on every hand signs of considerable industrial activity throughout this district, and makers of pig-iron are very fully employed. There is, indeed, every effort being made to complete the erection of new furnaces, which were commenced some short time ago, and of putting these in blast to increase the output. But as far as new business is concerned, the market is quiet, and there are indications that it will remain quiet during the next few months, as there is intelligence on every hand of the markets which get their chief supplies from this district being temporarily stocked, so that there is not much enquiry experienced. Very large cargoes of metal are being shipped to America, Australia, and elsewhere, and it is anticipated from present appearances that in a short time a good demand will spring up from the Continent and from South Africa. Prices have declined to about £4 15s. per ton for average Bessemer samples, and about £4 10s. for ordinary forge qualities of iron, but at these values the business doing is comparatively slight. The steel mills throughout the district are briskly employed, although no great weight of orders have recently been booked. Bessemer steel rails are at the maximum rate of output both for home and foreign railways, and there is every appearance of a large business being done in plates and ship steel generally, for which manufacture special machinery is being employed. Merchant qualities of steel are in considerable request, and at the finished-iron works in the district, where the greatest activity prevails, the introduction of steel amongst iron goods has been successfully attempted, and the blended metal is in good request. Iron ore mines are briskly employed, and there is very considerable output of the raw material, all of which is required to meet delivery engagements. There is not, however, so brisk a demand for ore as was experienced a short time ago. The coal trade is in an unsteady state, and sales are not large, especially to Irish consumers.

CONTINENTAL MINING AND METALLURGY.

BUSINESS in general seems inclined to settle at a lower level than it has had during the abnormal winter we have passed through. It is undeniable that there is business to do and doing, while it is equally certain that big parcels are being put on the market by dealers from last winter's contracts at rates to which buyers easily accommodate themselves. A decline is inevitable; it will be so far of advantage that the prices of pig and fuel will be brought back within common limits, and labour will be deprived of any temptation to aggression.

FRANCE.

The Paris market is in a disturbed state, owing to the operations of merchants and brokers, who exhibit an eagerness to sell which has demoralised consumers. The latter have got back to the position they took up last September, and are again watching prices to see if they are likely to come down for a permanence, and leave buyers free to go on from hand to mouth. The position is one trying to the nerves of forgemasters, who are not much comforted by the unsettled state of neighbouring markets. Still, they have not lost heart; and their quotations—whatever dealers' prices may be—have not sunk lower than they were in March. Nothing more was done at the meeting of Nord forgemasters on the 8th inst. than to re-affirm the rate of 240 fr. which has been established now for several weeks. It was stated that even yet orders had not been overtaken by the mills, and that for rails, beams and merchant varieties the campaign was saved for a good number of forges. One of the largest Paris houses is stated by *L'Ancre* to have lately placed a large contract for beams with a northern forge at the established rate of 240 fr., its action is pointed to as an indication of the true tendency of the market, which the house in question is particularly well placed for gauging. Circulars have been sent out by another Paris firm announcing that, practically, English and Scotch pig have won back their lost firmness, and offering No. 3 English at 98 fr. (£3 18s.) at Calais or Dunkirk, and No. 1 Gartsherrie at £4 10s. Swedish irons are being offered at Paris, duty not paid, at the following rates:—Nail rods, £15; Lancashire irons, £14 4s.; billets, £11 6s German offers of wire and wire elastics have been made successfully at Paris, prices being lower than those of corresponding French makers. Warrants for forge pig have gone up to 10 fr. 50, but exporters of steel rails will before long have warrants to dispose of in large quantity. Belleville and Co., the well-known boilermakers of Saint Denis, have lately received some heavy orders for boilers—nearly 1500 horse-power in all—for various home customers. The Madrid Gas Company has obtained authorisation to extend its operations in Spain, and will draw its materials from French mills. Scrap has lost value at Paris, crop ends have gone down to £5, old rails to £5 8s., machine castings £4, &c., and so on.

The East of France is generally well provided with orders, and holds out strongly against the depression, in spite of intermediate selling.

The Rhone and Loire are also in the same good condition, and the decline in rates has indeed been welcomed as having brought down the prices of raw materials. This is an important consideration where long-term contracts for finished goods have been booked by the mills. For rails and tires the Centre mills are said to be full for 1880 and 1881, and yet, at the end of the month, the State will probably put 20,000 to 25,000 tons of rails up to competition. The Eastern of France recently contracted for rails with St. Clamond at 280 fr. (£11 4s.) at the works, for a heavy line, and for 4000 tons of tires at £12. The latter order is spread over 4 years, and the contract price, though a moderate one, is not, therefore, unsatisfactory. Marrel frères are about to put up at Les Etangs, near Rive-de-Gier, a large hammer of 80 or 100 tons.

La Métallurgie, April 14, has received the following correspondence from the Loire:—"Up to the present time it would seem as if France had remained unconcerned in the progress, practically considered, of the dephosphorisation question, and had been distanced by her neighbours on the other side of the Rhine and the Channel. This is not quite the fact. One of the largest of French works began to study the Thomas-Gilchrist process as soon as it was brought out, and commenced with a practical application of it last November. After experimenting with it for some time, this establishment resolved to anticipate the result of its experimentation, and to put up at once plant for dephosphorising on a large scale. This establishment has been bolder than the Horde, or Ruhrort, or Angleur works, for it has applied the process to the first melting, and besides adapting it to the Bessemer converter, has fitted up a couple of Martin-Siemens furnaces, each of 15 tons capacity, for the treatment of phosphoretic material by the scrap process. In spite of the assertions of certain persons who, at the London meeting of May, 1879, let their wit outrun their judgment, dephosphorisation is effected as readily in the Martin furnace as in the converter, without needing to resort to other means of oxidation than those of the scrap process. At the time of writing the works in question have two 8-ton converters in operation, in which some 2000 tons of Thomas steel have been made of unexceptionable quality. About 20 blows are got with the same lining. The first Siemens-Martin furnace, fired about three months ago, has given about 120 tappings of 15 tons each without needing repairs excepting in the sole of the furnace, exactly as happens, with the common lining. Treating baths containing as much as 15 per cent. phosphorus, steel has been got containing no more than five ten-thousandths."

The dephosphorisation process is of growing interest to ironstone miners in the department of Aveyron (Chef-lieu Rhodez), in the South of France. Hopes are entertained of being able to utilise the poor ores found in that region.

The Société Métallurgique de Tarn-et-Garonne is in liquidation.

The Paris market for house-coal is in a state of collapse. Supplies are ample, the demand limited. The Western of France comments in its last report on the increased amount of English coal taken by the city of Paris. In 1879 Paris took 89,000 tons of English coal, or more, by 25,000 tons, than in 1878. This increase, which entered France by way of Dieppe, is attributed to the exceptionable severity of the winter months of 1879. Enlarged facilities having been given for discharging coal at the stations of Vaugirard, Grenelle and Champ-de-Mars, a diminution in coal traffic has been experienced at Batignolles, the traffic tending to spread itself over the remaining Paris stations. This is visible from the following figures, which show the amount of coal received in 1878 and 1879 at four Paris stations:—

	1878 tons.	1879 tons.
Batignolles	61,000	56,000
Grenelle	—	5000
Champ-de-Mars	8000	17,000
Vaugirard	5000	11,000

North of France coal rose at Paris from 29,000 tons in 1878 to 49,000 in 1879; the complaints which are now and then so loudly made of the ruin of French undertakings by foreign competition are ill supported by statistics.

We were unfortunate to attribute to *Le Charbon* some interesting statements concerning points of management at the Bessiges Colliery, which we really owed to *La Houille*. We join to our apology for this unintentional misattribution our compliments to *La Houille* for the general excellence of its reports. And we may perhaps indulge in the Phariseeism of pointing out that our contemporaries, whether of the English, French, or Belgian Press, very seldom take the trouble to quote any authority at all for the statements they annex.

BELGIUM.—The fluctuations in the English market embarrass operations on the Bourses of Belgium. The rate of 180 fr., which with 60 fr. duty comes up to the French rate of 240fr., is nominally maintained, and works which have orders still on their books have no desire to see this rate lowered. But new business does not come in so fast as old is worked out, and the number of forgemasters who have a margin of plant and labour unoccupied, is growing daily larger, and the advent of a fresh period of competition is by so much the nearer. There are some hopes that the present season, which is as favourable for building, both in Belgium and England, as last season was unfavourable, will bring with it a great increase of mill orders, but the duration of any such hope must now be a brief one. Quotations for pig are made at 90 fr. and 100 fr. (£3 12s. and £4), but it is not known how far these prices are actually paid. At Liege, No. 2 plate is tolerably firm at 240 fr. and 100 fr. (£7 12s.). At Charleroi the competition in split irons has led to a decline in rates for this favourite article of export. The coal market is depressed and unsettled, and English and German competition is felt in the north. The manufacturing coal is plentiful, and easy terms are anticipated by the large contractors with whom the bulk of business is done at this time of year. The Meuse navigation has been so far improved that a tug with a train of 300 tons of coal has for the first time made the journey from Liege to Givet.

GERMANY.—Prices are sinking in the German market as time goes on. Merchant irons, beams, and generally the principal articles of manufacture, have come down a little, and, as elsewhere, may settle for a while when they have become normal to real wants. There is a considerable amount of consumption going on, but offer and demand are now in equilibrium, if, indeed, there is not an overplus of make. Forgemasters still say they can wait, and are mostly booked forward till the autumn. Rail mills in Western Germany have, many of them, orders which will carry them well into next spring, but rail and longrine making are exceptionally well employed, owing in part to the recent acquisitions of important lines of rail by the State. Steel generally is in a favoured condition in Western Germany. The wire mills of Westphalia are suffering from an acute depression. Prices are low and the demand next to nothing. The darkening of demand is partly laid to the account of small makers of rivets and other articles made from wire, who, working by water power, had on hand a stock of material which the unexpected severity of the winter did not allow them to utilise. The exports, however, of Westphalian iron are usually very considerable. Plates remain in fair demand, and the inquiry for pig is maintained. It is on the steadiness of pig that is based the hope of a proximate stoppage of the downward movement of the prices of finished goods, it being argued that bars and girders cannot become much cheaper if forge pig keeps up its price. The Dortmund Union is credited with the intention of putting "several" *(mehrere)* furnaces on blast shortly; and this is taken as a sign of confidence in the future steadiness of trade. The coal market is at present in favour of buyers, and with cheap fuel pig-making ought to be profitable; but the collieries are beginning to put in force an agreement come to among them in last October to reduce the output for 1880 5 per cent. below that of 1879, *i.e.*, to pare down the amount due to the natural expansion of trade, and 5 per cent. beyond.

In the district of Siegen the reaction is tolerably sharp. Special local circumstances are adduced in explanation of this; but the fact of the reaction here has to be added to the sum of reactions going on elsewhere from some cause or other explained or unexplained, and the cause of all these reactions is simply a general German reaction. "The tempestuous advance in ironstone and iron," says a Berlin contemporary, "in Siegen came to an end in February, when it was evident that the enormous increase in value, both of raw material and finished goods, was very exaggerated. It has always characterised business in Siegen, that as soon as trade is brisk prices fly up without rhyme or reason, and as soon as it becomes flat they fall in the same way. The larger furnaces sell forward on contracts spread over several months; the smaller, with a relatively greater number of customers and no common action, sell out of hand, and prices ascend or descend as they are pressed with business or want it. Ironstone, from somewhat similar causes, has retrograded 20 per cent. The plate mills find it difficult now to sell their goods at a price corresponding with the cost of pig, as buyers are now distrustful, and are not to be tempted even by important concessions."

The following quotations were posted at Dortmund on the 12th inst.:—

	s.		s.
Spiegeleisen, No. 1	115	to	120
Forge pig, No. 1	90	„	95
German foundry pig, No 1 ..	95	„	100
„ Bessemer pig	110	„	115
Bars (standard)	—	„	175
Angles	185	„	190
Beams	175	„	180
Boiler plate	—	„	200
Charcoal plate	—	„	330
Bessemer rails	—	„	250
„ pit rails	220	„	230
Iron „	180	„	185

Dr. Wedding has read an interesting paper before the Berlin Society of Arts, on the first coke blast-furnace built in Germany—that is, as he contends, on the Continent. This was begun at Gleiwitz in 1794, under the superintendence of a German mining inspector, also Wedding by name. This was 12·89 m. high, with a capacity of 40·31 cubic metres. Up to about 1831 it made only 20 tons per week when at work; in 1850, it was replaced by a larger furnace on the same site. In 1873, a Karsten furnace was also set on blast, with which 100,000 tons of pig were made in a single season—being the highest amount ever reached by any furnace in Silesia.

NEW PATENTS.

ALL the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 1504 to No. 1607, being the entries from April 13th, to April 19th.

NEW APPLICATIONS.

Alkali Waste, &c.—*W. A. Hills, Saltney, near Chester, Flintshire.*	[1512
Apparatus for Holding and Binding Documents.—A communication.—*W. R. Lake, London.*	[1535
Apparatus for Raising Beer, &c.—*W. Martin, Manchester.*	[1501
Baths—*C. D. Douglas, London.*	[1538
Bicycles.—*J. Goodman, London.*	[1505
Bird and Vermin Scarer.—*J. C. Clive, Birmingham.*	[1550
Bottle Stopper—*E. T. Worssam, London.*	[1558
Brush Boring Machines.—A communication.—*H. J. Haddan, London.*	[1600
Brushes.—*F. A. Maurey-Deschamps, Paris.*	[1547
Calendering Machinery.—A communication.—*W. R. Lake, London.*	[1515
Chronometric Motor Apparatus.—A communication.—*W. R. Lake, London.*	[1586
Cigarette Papers.—*G. Olivier, Bordeaux.*	[1565
Coal-Oil Stoves.—A communication.—*H. A. Brugnard, Philadelphia, U.S.A.*	[1596
Coating Iron with Zinc or Tin.—A communication.—*W. R. Lake, London.*	[1606
Colouring Matter.—*A. Watt, London.*	[1516
Colouring of Photographs.—A communication.—*J. C. Mewburn, London.*	[1569
Composition for Ship' Bottoms.—*S. Ward, South Shields, Durham.*	[1542
Coverings for Trucks.—*O. Jones, London.*	[1602
Curry Combs.—A communication.—*J. Imray, London.*	[1595
Dies for Engraving.—*W. H. Fischer, Manchester.*	[1570
Distillation of Shale.—*W. Young, Clippens, Renfrewshire.*	[1578
Drying and Warming Boots and Shoes.—*F. Chenevix-Trench, Newbridge, Ireland.*	[1551
Dynamo-Electric Machines.—A communication.—*E. P. Alexander, London.*	[1580
Electric Lamps.—A communication.—*A. M. Clark, London.*	[1552
Electric Lamps.—A communication.—*C. D. Abel, London.*	[1553
Electric Lamps.—*G. G. Andre, Dorking, Surrey.*	[1507
Electro Magnets.—*G. Scarlett, Liverpool.*	[1585
Electro-plating.—*H. A. V. Wirth, London.*	[1556
Envelope Machines.—*D. M. Lester, Norwich, U.S.A.*	[1508
Exhibiting Pictures, &c.—*A. MacCallum, London.*	[1548
Feeding Bottles.—*G. Wells, London*	[1517
Fire Engines, &c.—*J. J. Royle, Manchester.*	[1523
Fishing Apparatus.—*J. W. de Caux, Great Yarmouth.*	[1559
Fluid Meters.—A communication.—*W. Morgan-Brown, London.*	[1537
Furnaces and Chimneys.—*N. Clayton and J. Shuttleworth, Lincoln, Lincolnshire.*	[1598
Gaffs for Fishing.—*T. H. Crawford, jun., Totnes, Devonshire.*	[1554
Gas Burners.—*A. E. Filer, London.*	[1582
Gas Burners.—*W. T. Sugg, London.*	[1545
Gas Flues.—A communication.—*C. Kesseler, Berlin.*	[1509
Gas Manufacture.—*J. H. Vale, Hamburg.*	[1546
Gas Soldering Irons.—*L. Quesnel, Paris.*	[1594
Grinding and Polishing Machinery.—*R. J. Edwards and A. Edwards, London.*	[1544
Heating Fluids.—A communication.—*W. R. Lake, London.*	[1514
Hose.—*C. Moseley, Manchester.*	[1522
Ice.—*F. N. Mackay, Liverpool.*	[1520
Improved Money Till.—*A. Steer, London.*	[1533
Indicators for Prime Movers.—*J. Casartelli, Manchester, and W. Potter, Lower Broughton, Lancashire.*	[1557
Knife-cleaning Apparatus.—*H. Courteen, London.*	[1532
Knitting Machines.—*T. Coltman, Leicester.*	[1555
Lamps.—*F. Siemens, Dresden, Germany.*	[1561
Life-saving Rafts.—A communication.—*H. J. Haddan, London.*	[1601
Lighting and Extinguishing Gas Burners.—A communication.—*F. H. F. Engel, Hamburg, Germany.*	[1567
Lighting and Heating by Gas.—*E. Liddle, Preston.*	[1539
Lighting Gas.—A communication.—*H. J. Haddan, London.*	[1528
Locking Heads of Landaus.—*G. J. Jacobs, Guildford.*	[1592
Lozenges.—A communication.—*H. J. Haddan, London.*	[1599
Looms.—*R. Illingworth, Blackburn, Lancashire.*	[1577
Manufacture of Tannin.—A communication.—*W. A. Barlow, London.*	[1568
Motive Power Engines.—*G. Stevenson, Airdrie, Lanarkshire.*	[1540
Motive Power Engines.—*P. W. Willans, London.*	[1572
Motive Power Engines.—*A. H. Hearington, Rochester, U.S.A.*	[1575
Money Tills.—*C. French and C. French, jun., London.*	[1527
Moving Earth.—*H. A. Carson, Massachusetts U.S.A.*	[1541
Multitubular Fire-arms.—*G. Pace, Valetta, Malta.*	[1504
Nails.—*G. W. Herbert, Birmingham.*	[1521
Oyster Dredges.—*F. A. Capps, Ealing, Middlesex.*	[1562
Packing Photographic Plates.—*B. J. Edwards, London.*	[1543
Pencil Sharpeners.—*M. C. Stone, Baltimore, U.S.A.*	[1603
Pneumatic Instruments for Measuring Temperature.—A communication.—*C. M. Sombart, Magdeburg, Germany.*	[1581
Printing Machinery.—*R. Hales and J. Exton, London.*	[1513
Prismatic Gunpowder.—A communication.—*C. Pieper, Berlin, Germany.*	[1576
Railroad Switches.—*J. B. Carey, Boston, U.S.A.*	[1518
Railway Brakes.—*C. T. Hulett, Ty-derwen Maesteg, Glamorganshire.*	[1604
Railway Brakes.—A communication.—*J. H. Johnson, London.*	[1563
Railway Buffers.—*W. Tijou, London.*	[1579
Reducing Friction of Axles, &c.—A communication.—*J. G. Wilson, Manchester.*	[1588
Repairing Screw Propellers.—*J. B. D'Arcy Boulton, London.*	[1573
Repeating Arms.—*A. Martin, London.*	[1531
Removing Incrustation from Boilers.—A communication.—*G. Davies, Manchester.*	[1564
Rolling Mill Apparatus.—*A. Berry, Tinsley, Yorkshire.*	[1597
Rotary Steam Engines.—A communication.—*P. Jensen, London.*	[1530
Spinning Machinery.—A communication.—*A. M. Clark, London.*	[1574
Stopping Leaks in Vessels.—*C. Nichols, Kingsand, Cornwall.*	[1593
Stoves for Drying Textile Fabrics.—*T. Bradford and F. Bolton, Manchester.*	[1525
Sugar Manufacture.—A communication.—*J. McLaren, Leeds, Yorkshire.*	[1536
Telegraph Insulators.—*G. Wells, London, and A. Gilbert, Worcester Park, Surrey.*	[1510
Telephone Switches.—A communication.—*J. H. Johnson, London.*	[1511
Textile Fabrics.—A communication.—*W. R. Lake, London.*	[1549
Textile Machinery.—*J. Whiteford, Paisley, Renfrewshire.*	[1529
Tills, &c.—*N. King, Portsmouth.*	[1560
Tool for Shaping Metals.—*A. Bidault, Paris.*	[1584
Turnstiles.—*G. Lowry, Salford.*	[1587
Velocipedes.—*W. Soper, Reading, Berkshire.*	[1607
Ventilation.—*J. B. Papier, London.*	[1505
Ventilation.—*W. Potts, Birmingham.*	[1590
Washing and Mixing Cement, &c.—*T. Matthews, Wood Green, Middlesex.*	[1524
Washing, &c., Machine.—*J. Bell, Paisley, Renfrewshire.*	[1583
Watch and Clock Dials.—A communication.—*H. A. Bonneville, London.*	[1605
Waterclosets.—*J. T. Cowe, Edinburgh.*	[1506
Waterclosets.—*W. Smith, San Francisco, U.S.A.*	[1534
Whips.—*P. Toberentz, Zirbst, Germany.*	[1526
Window Sashes.—*R. H. Thompson, London.*	[1571
Wool-Scouring Machinery.—*J. McNaught and W. McNaught, jun., Rochdale, Lancashire.*	[1519
Working Engine Valves.—*J. Robb, jun., Glasgow.*	[1589

COMMERCIAL.

MESSRS. ALLNUTT AND WOOD'S IRON FREIGHT REPORT.

RATES of freight for iron cargoes by steamers are easier, and the market is quiet, but for sailing vessels there is a fair enquiry, and the following rates have been paid: From Newport to New York a sailing vessel has been fixed at 12s. and 5 per cent. per ton old rails, and one from Cardiff to New York at 11s. per ton new rails. From Konigsberg to New York 14s. 6d. per ton old rails has been paid, and a vessel has accepted 30s. per ton for a cargo of pipes from Middlesborough to Adelaide, and a part cargo of pig-iron has been chartered for, from Middlesborough via Antwerp, to Yokohama, at 30s. per ton. From London to New York we have fixed for old rails at 9s. and 5 per cent., and from London to Cardiff old rails 4s. 6d. has been paid. A steamer has been fixed for a cargo of ore from Lisbon to Newport at 7s. per ton.

April 21st.

JAMES H. WEAGER AND CO.'S METAL REPORT.

MUCH depression has existed during the past week in this market, and prices have sustained a still further drop. Pig-iron, which took the initiative in the late upward movement, maintains the same attitude in the reverse position. Daily we experience a decline in price, notwithstanding that shipments continue good. We can only hope that, as in many other metals, speculative operators being forced to realise values have been depreciated, and that after confidence has been restored by the removal of middle parcels we shall see a corresponding improvement. Certainly it is difficult to find other tangible reasons for the present undue depression. Copper fully sympathises with the present condition of iron. 400 tons of Cape ore realised 13s., per unit, and at the Swansea ticketing on Tuesday last 1385 tons obtained 12s. 10½d. per unit for 9 per cent. Tin closes better after reaching £78 10s. There are plenty of buyers at £79 to £79 10s. Lead remains quiet at list prices. Tinplates easy. There are neither anxious buyers nor sellers, it being considered pretty certain that America must shortly come in. Our present prices for metals are:—Iron: Bars, Staffordshire, £8 to £8 10s.; hoops, £9 to £9 10s.; sheets, £10 to £10 10s. per ton. Copper: Chili slabs for 96 per cent., £59; English ingots and blocks, £67; English sheets, sheathing and rods, £74 per ton; yellow metal sheets and sheathing, 6½d. per lb. Tin: English ingots and blocks, £86 to £88 per ton; English bars, 4 cwt. barrels £87; foreign, Straits, £80; Australian, £80. per ton. Tinplates: coke, 22s.; charcoal, 25s. per box. Lead: Spanish pig, £16 7s. 6d.; English, £16 10s. to £16 12s. 6d.; bars, £17 5s.; pipe, £17 10s.; sheets, £17 5s. per ton. Zinc, £23 10s. Antimony, £69 per bottle. Quicksilver, £6 15s.

26, Leadenhall Street, E.C., April 22.

J. BERGER SPENCE AND CO.'S WEEKLY REPORT.

CHEMICALS.—The marked feature during the week has been a still further weakening in the prices of most articles in the chemical trade. The fact of large quantities of the leading staples being held in second hands has a detrimental influence for manufacturers, as the former, not having their hands burdened with raw materials, have not the same check against sacrificing values. The political situation will continue to exercise its influence for some time yet, and until the new Administration settles down into its place, we may expect the course of business to run on quietly. The recent advances in all commodities have caused the resuscitation of some works, the enlargement of others, and the erection of a certain number of new ones, and unless there is a still further development of the foreign demand, higher prices cannot be expected. The firmness with which the advance in freight to New York and other ports has been maintained, has necessarily had its effect upon the prices of our commodities. It is anticipated, however, that some reduction on the part of the steamship owners may be looked for. We note a further fall in the price of bleaching powder during the week, and there are anxious sellers of this article for immediate delivery; prices for forward delivery remain, however, firm. Caustic soda of all descriptions has participated in the general reduction to a considerable extent, the higher strengths of white having been particularly slow of sale. Oxalic acid, chlorate of potash, and sugar of lead, have all had a retrograde movement. Acetate of lime is in more plentiful supply.

MINERALS.—The sympathy between minerals and metals is too intimate for the decline in value of the latter not to have its effects upon the various classes of the former, especially of iron, copper, and lead ores, which are much less sought after. Even the first-class qualities of iron ore have now to be pushed to find buyers, whilst lower qualities are unsaleable, as in the past. The work at the mines that were being opened up again is going on more slowly and more slowly, prudence dictating the advisability of watching the iron market before sinking money in the development of same. Brimstone: sales of this are being pushed, and prices are on the decline. China clay, which was about the last to feel improvement, maintains itself about the best.

In coal there is less anxiety on the part of consumers to cover themselves, and it must be noted also that, on the other hand, colliery proprietors are indifferent about selling far ahead, except upon their own terms. Manganese of high quality is sought after, and full prices can be realised.

Metals.—The strong efforts that are being made in the various branches of the metal trade to sustain prices prove unavailing. This is evinced in a very marked manner by the slight advances that are being obtained one day being lost, and more, the next. The healthier tone prevailing in the Middlesborough iron district a week ago has given way, and again easier. The holders of hematite pig-iron show much more anxiety to sell even months ahead at the reduced figures, but buyers prefer holding off to wait events. In a few weeks the new Government will be in office, and matters may then commence to assume a better aspect, but it will be some little time before any marked alteration takes place. In lead we have to note a slight improvement. Copper and tin about the same as last week. Spelter very satisfactorily holds its position, with little tendency to follow the downward course of other metals.

General Items.—The total receipts of the railways of Prussia in 1879 were 550 million marks, or £27,500,000, The working expenditure was 310 million marks, or £15,500,000 leaving 240 million marks, or £12,000,000 for distribution among the shareholders. This is equivalent to an average dividend of 4·9 per cent. on the capital invested.

Manchester, April 17th, 1880.

SOUTH WALES COAL SHIPMENTS,
MARCH, 1880.

Summary of foreign coal shipments from Cardiff, Newport, Swansea and Llanelly, during the month of *March*, 1880:—

	Tons.		Tons.
Aden..	4,529	Madeira	3,199
Alexandria	6,470	Malta	25,581
Alicante	4,638	Marseilles	1,811
Amsterdam	1,176	Martinique	1,176
Anjer	2,108	Mataro	229
Antwerp	1,993	Messina	4,322
Bahia	1,653	Monte Video ..	8,928
Barbadoes	127	Naples	5,834
Barcelona	13,002	Odessa	11,300
Bayonne	367	Oporto	1,205
Bergen	704	Palermo	5,970
Bilbao	3,384	Palma	926
Bombay	8,939	Para	1,381
Bordeaux	13,392	Pernambuco ..	1,605
Boulogne	2,378	Port Said	29,232
Brest..	2,450	Riga	697
Brindisi	2,273	Rio de Janeiro ..	8,864
Buenos Ayres ..	3,186	Rio Grande do Sul..	476
Cadiz	2,525	Rivero	703
Calcutta	2,100	Rochfort	6,675
Cape de Verds ..	12,012	Salonica	64
Cape Town	9,288	Santander	400
Ceylon	2,300	Santiago	374
Constantinople ..	4,521	Santos	563
Copenhagen	2,649	Savona	9,265
Coquimbo	1,144	Seville	3,285
Cronstadt	940	Singapore	15,231
Dantzic	752	Smyrna	3,143
Demerara	451	St. Lucia	710
Fayal	2,430	St. Thomas	3,476
Galatz and Danube..	282	Stettin	3,156
Genoa	24,485	Stockholm	523
Gibraltar	28,144	Swinemunde ..	123
Guadaloupe	2,384	Syra..	1,502
Hamburg	1,306	Tarragona	1,238
Havannah	5,071	Teneriffe	858
Hong Kong.. ..	12,405	Trieste	4,031
Jamaica	3,278	Valencia	458
Java	4,446	Valparaiso	4,248
La Rochelle.. ..	11,931	Venice	3,207
Leghorn	261	Zante	733
Lisbon	10,399		

SCOTCH PIG-IRON.

Annexed is a weekly statement of the shipments during this and the previous three years :—

Week end.	1880 Tons	1879 Tons	1878 Tons	1877 Tons
Jan. 3 ..	6677	4655	2441	3454
10 ..	6689	6069	6085	6500
17 ..	12,288	6291	4532	5141
24 ..	7566	6331	6170	7040
31 ..	13,383	4969	6550	5297
Feb. 7 ..	14,190	6130	5637	6183
14 ..	10,612	7272	5722	5839
21 ..	15,152	8996	5124	6559
28 ..	12,603	8318	7836	8630
March 6 ..	17,968	13,910	6816	8048
" 13 ..	20,985	10,743	8662	7280
" 20 ..	20,987	11,167	7725	9312
" 27 ..	23,598	9,463	11,499	10,246
April 3..	15,722	12,653	7448	9071
" 10 ..	18,309	12,913	9441	10,721
" 17 ..	15,784	13,228	9513	10,020
Total ..	235,613	143,108	111,201	117,631

PARTNERSHIPS DISSOLVED.

Handley and Finch, Maldon, Essex, shipwrights.—Ardrey, Diggle and Tootill, Radcliffe, Lancashire, machine and spindle makers.—J. Jessop, C. J. Appleby and T. H. Appleby, Leicester, engineers.—Pearson and Johnson, Bury, Lancashire, engineers.—Cox, Farley and Co., Falmouth, engineers.—Lister and J. Knowles, Sheffield, cutlery manufacturers.—J. Cook, B. Hardy and W. K. Buttolph, Walton, Norfolk, ironfounders; as far as regards B. Hardy.—Turner, Foster and Co., Halifax, wheelwrights.—Clarke and Pickwell, Kingston-upon-Hull, civil engineers, and Barrow-upon-Humber, brick and tile manufacturers.—C. Powis, Carter and Morris, Gracechurch Street, City, mechanical engineers; as far as regards E. R. Morris.

MESSRS. RICHARDSON AND CO'S SWANSEA COPPER ORE CIRCULAR (April 20, 1880).

	Mines.	21 Cwt.	Produces.	Excess. s. d.	Amount of each Parcel. £ s. d.	Amount of each Mine. £ s. d.
1	Caveira Ore	94	9	1 0	514 13 0	
2	"	93	9	—	506 17 0	
3	"	93	9	—	509 3 6	
4	"	79	9½	0 6	456 4 6	
5	"	79	9½	—	452 5 6	
6	"	79	9⅜	1 6	454 5 0	
7	"	78	9⅜	1 6	450 9 0	
						3343 17 6
8	Betts Cove Ore	120	6½	1 6	498 0 0	
9	"	120	6½	2 0	498 0 0	
10	"	83	7⅜	2 0	398 8 0	
11	"	82	7⅜	1 0	393 12 0	
12	"	82	7¼	1 0	393 12 0	
13	"	82	7¼	0 6	393 12 0	
						2575 4 0
15	Copper Ore	93	5	2 6	295 5 6	
16	"	10	47	2 6	332 10 0	
17	"	3	45¾	16 6	93 4 6	
						691 0 0
18	Sobral Ore	51	15¼	4 6		527 17 0
19	Cambrian Ore No. 1 ..	15	21	3 0	204 15 0	
20	" " 2 ..	21	19	7 0	273 0 0	
21	" " 3 ..	14	9⅛	1 6	87 10 0	
						565 5 0
22	Tigrony Precipt.	7	23½	16 6		97 13 0
23	Copper Precipt.	6	51½	6 0	189 18 0	
24	"	1	4½	10 0	1 10 0	
						191 8 0
		1385				£7992 4 6

No sale May 4th.

Averages. Mines.	21 cwt.	Produce per cent.	Copper Contents. tons cwt. qr. lb.	Price per 21 cwt. for Ore. £ s. d.	Price per 21 cwt. of Ore Copper. £ s. d.	Price per unit of Produce. s. d.	Total gross value. £ s. d.
Caveira ..	595	9 1-16	53 18 3 15	5 12 5	61 19 9	12 4¾	3343 17 6
Betts Cove ..	569	6 13-16	38 15 0 20	4 10 6	66 8 10	13 3¼	2575 4 0
Sobral ..	51	15¼	7 15 2 6	10 7 0	67 17 4	13 6¾	527 17 0
Cambrian ..	50	16 13-16	8 8 1 12	11 6 1	67 3 0	13 5	565 5 0
Whole Sale ..	1385	9	124 7 2 0	5 15 5	64 5 2	12 10¼	7992 4 6

FURNACES IN AND OUT OF BLAST.

The following list of furnaces in and out of blast in the South Staffordshire district is issued by Messrs. Charles Rylands and Son, of Birmingham, March 31st, 1880.

Proprietors.	District.	In.	Out.	No.
Addenbrookes, Smith and Pidcock	Rough Hay ..	1	2	3
Bagnall, J., and Sons, Limited	West Bromwich	2	1	3
Bradley, John, and Co. ..	Shut End ..	1	3	4
Brook Furnaces Iron Co. ..	Bilston ..	0	3	3
Brook Furnaces Iron Co. ..	Capponfield ..	1	2	3
Barbor's Field Co., The ..	Bilston ..	1	1	2
British Iron Co., The New..	Congreaves ..	3	3	6
Bromley Hall Coal and Iron Co.	New Corbyns Hall ..	0	4	4
Colbourn, Sons, and Co. ..	Tipton ..	0	2	2
Colbourn, Sons, and Co. ..	Park Lane ..	1	1	2
Chillington Iron Co., Limited.	Wolverhampton	0	4	4
Chillington Iron Co., Limited	Bentley ..	0	2	2
Cochrane and Co.	Woodside ..	2	1	3
Castle Iron Co.	Birchills ..	0	2	2
Dudley, Earl of	Coneygre ..	1	2	3
Dudley, Earl of	Level ..	3	2	5
.. ..	Deepfields ..	0	3	3
Dunn, John and George ..	Withymoor ..	0	2	2
Darlaston Coal and Iron Co., Limited	Darlaston ..	0	1	1
Firmstone, W. and G. ..	Crookhay ..	1	3	4
Firmstone, W. and G. ..	Brierley Hill ..	1	2	3
Groucutt, Samuel, and Sons	Wednesbury ..	1	2	3
Grazebrook, M. and W.	Netherton ..	1	1	2
.. .. ..	Groveland ..	0	1	1
Hickman, Alfred	Spring Vale ..	4	0	4
Hingley, N., and Sons ..	Old Hill ..	1	1	2
Holcroft, James	Brierley Hill ..	1	1	2
Jones, John, and Sons ..	Walsall ..	1	1	2
Jones, John, and Sons ..	Dudley ..	1	0	1
Jones, David, and Sons ..	Darlaston ..	1	0	1
Mathews, W., and Co., Limited	Corbyns Hall..	1	2	3
Osier Bed Iron Co.	Wolverhampton	0	3	3
Onions, George, Sen. ..	Brades Hall ..	2	0	2
Onions, Edwin*	Dudley Port ..	0	1	1
Pearson, J. H.§	Windmill End	1	2	3
Pearson, J. H.	Netherton ..	2	0	2
Patent Shaft and Axletree Co., Limited.	Old Park ..	0	3	3
Pelsall Coal & Iron Co., Limited	Pelsall.. ..	1	1	2
Phillips and McEwen ..	Parkhead ..	1	1	2
Roberts and Co.	Tipton ..	4	0	4
Rose, David	Moxley ..	1	1	2
Round Brothers	Tipton ..	1	1	2
Sparrow, W. and J. S., and Co.	Millfields ..	2	1	3
Stour Valley Coal and Iron Co., Limited	West Bromwich	2	1	3
Swan Iron Co., The.. ..	Darlaston ..	2	0	2
Tame Iron Co.	Bilston ..	2	0	2
Turley, Thomas, and Sons..	Tipton ..	1	1	2
Thorneycroft, G. B., and Co.	Wolverhampton	0	2	2
Thomas, G. and R.	Walsall ..	2	0	2
Williams, P., and Sons ..	Tipton ..	1	1	2
Ward, W., and Sons ..	Priestfield ..	0	2	2
Whitehouse, H. B., and Sons	Priorsfield ..	3	0	3
Willenhall Furnaces, Limited, The	Willenhall ..	2	1	3
Willingsworth Iron Co. ..	Wednesbury ..	1	1	2
Williams Brothers	Birchills ..	0	2	2
Williams, J. and T... ..	Wolverhampton	2	3	5

There are 146 furnaces built; 63 in blast, and 83 out.

Messrs. W. and G. Firmstone have 3 furnaces out of blast at Crookhay, 1 of which has been out of blast for 20 years.

Messrs. Williams Brothers have 2 furnaces at Birchills, which have been out of blast for some years.

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* Out for repairs. § 1 Rebuilding.

NEW COMPANIES.

Bultfontein Homestead.—On the 8th inst. this company was registered with a capital of £35,000 in £10 shares, to acquire 44 claims of 30 feet square each forming part of the Homestead Reserve within the Bultfontein diggings at Bultfontein, Griqualand West in South Africa, with the right to dig or search for diamonds and other precious stones therein.

Cardiff Incorporated Chamber of Commerce.—This is the incorporation, under the Companies Act 1862 to 1879, as a company, limited by guarantee to £5 each member, of the existing Cardiff Chamber of Commerce, which was established 1866. It was registered 8th inst., with a special license from the Board of Trade authorising the omission of the word limited from the title.

East Prevor Tin and Copper Mining.—On the 13th inst., this company was incorporated with a capital of £15,000 in £10 shares, to purchase certain mines mentioned in an unregistered agreement of 12th inst., between Thomas Parkin and Villeroy Corney Doubleday.

Fawler Coal and Iron.—This company proposes to acquire the Fawler Mines in Oxfordshire demised by the Duke of Marlborough to Lieutenant-Colonel Francis John Bolton, of 19, Grosvenor Gardens. It was registered 10th inst., with a capital of £20,000 in £10 shares.

Hants and Berks Farmers' Steam Ploughing and Cultivating.—This is the conversion to a company of the business of letting out on hire steam ploughing and cultivating machinery carried on by Mr. William Clarke Dixon, at New Street and Brook Street, Basingstoke. It was registered 8th inst., with a capital of £20,000 in £5 shares, of which 1000 shares are preference.

Messrs. Tom Miles Richards, and Co.—This company proposes to acquire coal, tin, iron and steel works situated in the hamlet of Clyne, parish of Llantwit-juxta-Neath, in the county of Glamorgan. It was registered 13th inst., with a capital of £20,000 in £100 shares.

New Chance Mining.—This company proposes to take over the property and assets of the Last Chance Silver Mining Company of Utah, Limited. It was registered 13th inst., with a capital of £60,000 in £1 shares.

New Holmbush Mining.—Upon terms of an agreement of the 6th inst., this company proposes to purchase and work certain arsenic and copper mining properties in the parish of Stoke Clims, near Callington, in East Cornwall, known as the Holmbush and Kelly Bray Mines. It was registered 7th inst., with a capital of £40,000 in £4 shares. The property will be purchased from the Credit Company, Limited, for the sum of £5000.

New Vronheulog Slate.—This company was registered 10th inst., with a capital of £20,000 in £20 shares, to work the mines and quarries called Vronheulog, Taleithin-isaf, and Caernaw, and other lands, situate in the parish of Llianlbyful, in the county of Carnarvon.

Nilgherry and South Indian Gold Mining Syndicate.—This company proposes to acquire mineral or other property in Southern India, and particularly interest in a tract 18 of miles or thereabouts situate in Travancore, southward of the Wynaad District. It was registered 7th inst., with a capital of £7500 in £1 shares.

Sydney and Louisburg Coal and Railway.—Upon terms of an agreement of 5th inst., this company proposes to purchase from the Cape Breton Company, Limited, certain mining property in Nova Scotia with the railway, and other appurtenances of the same. It was registered 13th inst., with a capital of £314,770 in £10. The purchase consideration is £15,000.

Whitehaven Shipbuilding.—This is the reconstruction of a company of same name now in liquidation. It was registered 9th inst., with a capital of £80,000 in £20 shares.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

Metal Market, City, Thursday Afternoon, 4 P.M.

(*April* 22, 1880.)

METALS AND ORES.

	April 15. £ s.	 £ s.	April 22. £ s.	 £ s.
Copper (per ton)—				
Chili, for 96 per cent.	61 0/	—	59 5/	—
Wallaroo	78 0/	79 0/	77 0/	78 0/
Burra Burra	76 0/	76 10/	75 0/	76 0/
English Tough	70 0/	71 0/	67 0/	69 0/
English Ingot, best..	71 0/	73 0/	68 0/	70 0/
Sheets sheathing and rod ...	76 0/	—	74 0/	—
Bottoms	81 0/	—	79 0/	—
Ore per unit	0 13/9	—	0 13/	0 13/6
Phosphor Bronze				
Special Bearing Metal (p tn)	116 0/	—	116 0/	—
Other alloys (per ton	123 0/	139 0/	123 0/	139 0/

	April 15.		April 22.	
	£ s.	£ s.	£ s.	£ s.
Tin (per ton)—				
Straits (Cash)	81 0/	—	80 0/	—
Do. for arr.	—	—	—	—
Billiton	—	—	—	—
Banca	—	—	—	—
English Ingots	90 0/	—	86 0/	88 0/
Do. Bars	91 0/	—	87 0/	—
Do. Refined	93 0/	—	89 0/	90 0/
Australian	81 0/	—	80 0/	—
Tin Plates, per box, I.C. coke f.o.b. London	0 22/	0 24/	0 22/	0 24/
IX. do.	0 27/	0 29/	0 27/	0 29/
I.C. charcoal	0 26/	0 30/	0 26/	0 30/
I.X ,,	0 32/	0 36/	0 32/	0 36/
Lead (per ton)—				
Soft English pig	16 15/	17 0/	16 10/	—
Do. W.B.	—	—	—	—
Spanish soft	16 10/	—	16 5/	—
Do. with silver	—	—	—	—
Sheet milled	17 0/	—	17 0/	—
Red lead	17 10/	—	17 10/	—
White	22 0/	—	22 0/	—
Patent shot	20 10/	—	20 10/	—
Zinc (per ton)—from No. 9 Gauge.				
Sheets, rolled	23 10/	—	23 10/	—
Do., foreign	24 0/	—	24 0/	—
Spelter (per ton)—				
Silesian, com	20 15/	—	20 15/	—
Rhenish	—	—	—	—
English	—	—	—	—
Quicksilver, bot.	6 15/	—	6 15/	—
Antimony ore (per ton)—				
Australian	11 10/	14 10/	11 10/	14 10/
Spanish	—	—	—	—
French Star	71 0/	72 0/	69 0/	—
Regulus—				
Crude (per cwt.)	1 14/	—	1 14/	—
Nickel (per lb.)	0 3/6	—	0 3/6	—
Brass (per lb.)—				
Sheets, 48×24.	0 0/8	—	0 0/8	—
Tubes	0 0/11	0 1/	0 0/11	0 1/
Wire	0 0/8¼	—	0 0/8¼	—
Yellow metal	0 0/6½	—	0 0/6½	—
Asbestos (per lb.)	0 0/3	0 0/6¾	0 0/3	0 0/6¾
Plumbago (per ton)—				
Ceylon lump	0 17/6	—	0 17/6	—
Do. chip	0 10/6	—	0 10/6	—
Do. dust	8 6/	—	8 6/	—
Coals (per ton)—				
East Hartlepool	1 2/	—	1 2/	—
Lambton	1 4/	—	1 4/	—
Tees	1 4/	—	1 4/	—
Hartley	1 2/	—	1 2/	—
Hetton	1 4/	—	1 4/	—
Hawthorn	1 3/	—	1 3/	—
Tunstall	1 2/	—	1 2/	—

IRON.

	April 15.		April 22.	
Iron, per ton (at works)*—	£ s.	£ s.	£ s.	£ s.
Bars, Welsh, common	7 5/	7 10/	7 5/	7 10/
Do. Best	8 10/	8 15/	8 10/	8 15/
Scotch, Common	9 0/	—	9 0/	—
Do. Best	9 10/	—	9 10/	—
South Stafford, common	7 10/	8 0/	7 10/	8 0/
Do. Best	8 0/	9 0/	8 0/	9 0/
Sheets, singles, Cleveland	9 15/	10 0/	9 15/	10 0/
Staffordshire	10 0/	11 0/	10 0/	11 0/
Do. doubles, Staffordshire	11 10/	12 10/	11 10/	12 10/
Do. Lattens, Staffordshire	13 0/	14 0/	13 0/	14 0/
Plates, Ship, Stafford.	10 0/	10 10/	10 0/	10 10/
Do. Scotch	—	—	—	—
Do. Boiler, Stafford.	10 10/	11 10/	10 10/	11 10/
Hoops, Stafford	9 0/	9 10/	9 0/	9 10/
Nail Rods, Stafford	8 10/	9 0/	8 10/	9 0/
Swedish in Lond.	11 11/	12 0/	11 11/	12 0/
Angle Iron, Welsh	—	—	—	—
Do. Stafford	8 15/	9 10/	8 15/	9 10/
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 10/	—	6 10/	—
Do. Scotch	—	—	—	—
Rails, Welsh	8 0/	8 10/	8 0/	8 10/
Do. Stafford	8 10/	9 10/	8 10/	9 10/
North England	5 5/	—	—	—
Light Rails, Welsh	8 5/	8 15/	8 5/	8 15/
Do. Stafford	8 15/	9 15/	8 15/	9 15/
Pig Iron at Glasgow				
Scotch warrants	2 16/6	—	2 8/6	—
Do. No. 1	2 19/	3 5/	2 12/	3 5/
Cleveland, Tyne or Tees	2 18/	3 0/	2 18/	3 0/
Indian Charcoal, London	—	—	—	—
Wrought Iron Girders	18 0/	24 0/	18 0/	24 0/
Bolts and Nuts	18 0/	21 0/	18 0/	21 0/
Fish Bolts	18 0/	23 0/	18 0/	23 0/
Washers	18 10/	19 0/	18 10/	19 0/
Rivets	15 0/	18 0/	15 0/	18 0/
Spikes	17 10/	19 10/	17 10/	19 10/
Swedish Iron— f.o.b. Gottenburg, nett cash.				
Pig	—	—	—	—
Bar, rolled	11 10/	12 0/	11 10/	12 0/
Do. hammered	12 0/	12 10/	12 0/	12 10/
Billets	12 0/*	—	12 0/	—
Horse Nail Rods	—	—	—	—
Belgian Iron—				
f.o.b. Antwerp, less 2½ per cent.	8 0/	—	8 0/	—
Bars and Slit Rods, common	Nominal.			
Best				
Best Best				
Hammered				
Puddled Steel				
Bessemer				
Hoops				
Rails				
Rolled Girders				
Steel—				
Best cast	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear	45 0/	—	45 0/	—
Do. single do.	38 0/	40 0/	38 0/	40 0/
English spring med. quality	14 0/	18 0/	14 0/	18 0/
Blister	21 0/	34 0/	21 0/	34 0/
Swedish keg	16 0/	—	16 0/	—
Milan	18 0/	19 0/	18 0/	19 0/
Bessemer rails	10 5/	10 10/	10 5/	10 10/
Scrap (per ton)—				
Old rails for remanufacture, D.H.	6 10/	—	6 10/	—
Ditto flange or bridge	4 10/	6 0/	4 10/	6 0/
Engineers' scrap	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal	2 0/	3 0/	2 0/	3 0/
Old steel scrap	3 15/	4 10/	3 15/	4 10/
Wire—				
Best best drawn killed gal. tel., Nos. 0 to 6	18 10/	—	18 10/	—
Do. 7 & 8	19 10/	—	19 10/	—
Do. 9	20 5/	—	20 5/	—
Do. 10	21 0/	—	21 0/	—
Do. 11	21 10/	—	21 10/	—
Do. 12	22 10/	—	22 10/	—
Rolled black fencing wire (per ton) 1 to 4	10 10/	—	11 10/	—
Do. 5	12 0/	—	12 0/	—
Do. 6	12 10/	—	12 10/	—
Do. 7	13 0/	—	13 0/	—
Bright Iron Wire (Charcoal wire, 4s. 6d. per bundle extra) per bundle of 63 lb. 0 to 6	0 14/6	—	0 14/6	—
Do. 7 to 8	0 15/	0 15/3	0 15/	0 15/3
Galvanised, 80s. per ton extra.				
Best best annealed drawn fencing wire, per ton 0 to 6	13 15/	—	13 15/	—
Do. 7	13 15/	—	13 15/	—
Do. 8	14 0/	—	14 0/	—
Castings (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 1½ to 2in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 ,, 4	6 2/6	6 5/	6 2/6	5 5/
Do. 5 ,, 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 ,,16	6 0/	6 2/6	6 0/	6 2/6
Do. 18 ,,24	5 17/6	6 0/	5 17/6	6 0/
Bolts and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	19 10/	21 10/	19 10/	21 10/

* The entire ton consists of ten times 100 kilogrammes, or about 30 lb. short of an English ton.

OILS, CHEMICALS, &c.

	April 15.		April 22.	
Oils (per ton)—	£ s.	£ s.	£ s.	£ s.
Olive, Malaga	—	—	—	—
Do. Gioja	44 10/	—	44 10/	—
Do. Levant	42 0/	43 0/	42 0/	43 0/
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	44 10/	45 0/	44 10/	45 0/
Do. Sicily	45 0/	46 0/	45 0/	46 0/
Seal, pale	30 0/	30 10/	30 0/	30 10/
Seal, yellow	27 0/	—	27 0/	—
Seal, brown	25 0/	—	25 0/	—
Sperm head	75 0/	—	75 0/	—
Cod	26 0/	26 10/	26 0/	26 10/
Whale, pale	26 10/	—	26 10/	—
Do. yellow	25 10/	—	25 10/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	29 10/	—	29 10/	—
Do. brown	27 10/	—	27 10/	—
Foreign Pale	—	—	—	—
Ground nut and Gingelly Madr.	30 10/	31 0/	30 10/	31 0/
Palm oil, fine	31 0/	31 10/	31 0/	31 10/
Palm nut oil	33 10/	—	33 0/	—
Linseed oil	27 5/	—	27 5/	—
Cotton seed oil	26 15/	27 5/	26 15/	27 5/
Lard	42 0/	44 0/	42 0/	44 0/
Cocoanut, Cochin	36 0/	37 10/	35 0/	37 0/
Do. Ceylon	33 0/	—	33 0/	—
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent engine oil (per gal.)	0 3/6	—	0 3/6	—
Oil Cake (per ton)—				
Linseed, Lndn.	11 0/	—	10 0/	11 0/
American bls.	10 10/	10 12/6	10 2/6	10 5/
Do. bags	9 2/6	9 5/	9 2/6	9 5/
Marseilles	9 5/	—	9 5/	—
Rape, English	5 0/	—	5 0/	—
Do. Foreign	—	—	—	—
Green Cotton	5 17/6	7 0/	5 17/6	7 0/
Tallow—PYC.	43 0/	—	43 0/	—
S. Americn. Beef	41 0/	—	41 0/	—
Do. Sheep	36 0/	—	36 0/	—
Australian Beef	30 0/	33 0/	32 0/	—
Do. Sheep	34 10/	—	34 0/	—
Rough Town Fat	14 0/	—	14 0/	—
Petroleum—				
Fine (per gal.)	0 0/5¾	0 0/6¼	0 0/6	—
Do. spirit	0 0/7¼	—	0 0/7¼	—
Turpentine—Spirit—				
French	—	—	—	—
American (casks)	1 15/	—	1 15/	—
Whalefins (per. ton)—				
Davis' Straits	1000 0/	—	1000 0/	—
Arctic	950 0/	1000 0/	950 0/	1000 0/
Southern	500 0/	—	500 0/	—
Brimstone (per ton)—				
Rough, 2ds Ind.	7 0/	—	7 0/	—
Do. 3rds, do	5 10/	—	5 10/	—
Roll	9 10/	10 5/	9 10/	10 5/
Sulphur, Flour (per cwt.)	0 10/9	0 12/6	0 10/9	0 12/6
Acid, (per lb.)				
Acetic, fine	0 0/3	0 0/3 3-14	0 0/3	0 0/3 3-14
Do. common (per gal.)	0 1/5	0 1/6	0 1/5	0 1/6
Citric	0 2/9	—	0 2/9	—
Muriatic fine (per cwt.)	0 4/	0 7/	0 4/	0 7/
Do. common	0 4/	0 5/	0 4/	0 5/
Nitric	0 0/4½	—	0 0/4½	—
Oxalic (per lb.)	0 0/5	—	0 0/5	—
Sulphuric, concentrated	0 0/1	—	0 0/1	—
Do. Brown	0 0/0¾	0 0/1	0 0/0¾	0 0/1
Tartaric Crystal	0 1/9	—	0 1/9	—
Do. Pulv.	0 1/9	—	0 1/9	—
Ammonia—				
Carbonate, per lb.	0 0/6½	0 0/6¾	0 0/6½	0 0/6¾
Sulphate, White & grey (per ton)	19 0/	—	19 0/	—
Arsenic—White Lump (per ton)	23 10/	—	23 10/	—
Powdered, do.	11 0/	—	11 0/	—
Bleaching powder	0 8/6	—	0 8/6	—
Borax, Rfd., do.	3 5/	—	3 5/	—
Copperas (ton)	2 15/	3 5/	2 15/	3 5/
Portland Cement—				
1st quality, in cks 400 lb. gross, inc. csks., f.o.b., Thames, per csk.	0 9/	—	0 9/	—
Do. in sks, 200lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/6 each.				
Charlton White Paint (per cwt.)	1 12/	—	1 12/	—
Calley's Torbay Paint, Brown	0 30/	—	0 30/	—
Do. Red	0 34/	—	0 34/	—
Hypophosphites (per lb.)—				
Iron	0 9/3	0 10/	0 9/3	0 10/
Lime	0 5/3	0 7/	0 5/3	0 7/
Magnesia	0 9/	0 9/	0 9/	0 9/
Manganese	0 9/	0 9/	0 9/	0 9/
Soda	0 5/3	0 6/	0 5/3	0 6/
Lead (per cwt.)—				
Acetate, ...best	2 0/	—	2 0/	—
Nitrate	1 15/	—	1 15/	—
Red (per cwt.)	0 18/	—	0 23/	—
White	1 4/	—	1 4/	—
Litharge (pr cwt.)	1 2/	—	1 1/	—
Lime (per ton)—				
Acetate, Grey, 85%	19 0/	—	19 0/	—
Do. Brown 70%	14 0/	—	14 0/	—
Potash—				
Bichromate (lb.)	0 0/6¾	0 0/7	0 0/6¾	0 0/7
Chlorate (pr. lb.)	0 0/7¾	—	0 0/7¾	—
Muriate, 80% ton	6 15/	—	6 15/	—
Pruss. Red (lb.)	0 1/8	0 1/10½	0 1/8	0 1/10½
Do. Yel. lb.	0 0/11¼	0 1/	0 0/11¼	0 1/
Sulphate, 80% (per ton)	9 0/	10 0/	9 0/	10 0/
Saltpetre (per cwt.)—				
Engl. refnd. kgs.	1 8/3	—	1 8/3	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 19/6	1 1/6	0 19/6	1 1/6
Soda—				
Ash ... deg.	0 0/1 15-16	0 2/	0 0/1 15-16	0 2/
Bicarb. (per cwt.)	0 12/	—	0 12/	—
Caustic, 60% to 72%	0 12/	0 12/6	0 12/	0 12/6
Nitrate (per ton)	17 10/	—	17 0/	—
Crystals (per ton)	3 15/	—	3 10/	—

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* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

PRICES CURRENT OF MANUFACTURED GOODS

OF

BIRMINGHAM AND DISTRICT.

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The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material.

The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

April 22nd, 1880.

Last week we had to report falling markets in both iron and hardware, and reductions in Bromsgrove nails, gas tubes, heavy and light washers, plate locks, brass lock furniture, ashpan and other knobs in brass. This week, the iron and metal markets are still lower, and brass wire, sheets, tubes, also copper wire, sheets and tubes are all reduced ½d. per lb. The same applies to solid drawn tubes, and brass jelly pans are all reduced ½d. per lb. In the iron branches of hardware heavy goods are coming down, and black and tinned odd work makers have reduced their prices 10 per cent. on the net. Bolts and nuts, coach screws, ship rivets and heavy washers have gradually been reduced the last two months, and the associated makers have now officially declared their list down £2 per ton on heavy bolts and 6d. per gross on the light ones sold by the gross. This brings their list down to what it stood on January 1878. Norfolk and Suffolk latches are being offered at 5 per cent. more discount, and chains, cables and anchors are all reduced some 2s. per cent. over prices two months ago. Our list will give present prices of brass goods, and bolts and nuts, and chains and cables and anchors we quote as follows at the works in South Staffordshire:—Best short link riggings, chains ¼ in. 21s. 6d.; ⅜ in. 17s. 3d., ½ in. 14s., ⅝ in. 13s. 6d., ¾ in. 13s., ⅞ in. 12s. 6d., 1 in. 12s.; stud cables proved, ⅝ in. 13s. 9d.; 11-16th in. 13s. 6d., ¾ in. 13s. 3d., ⅞ in. 12s. 9d., 1 in. 12s. 3d., 1⅛ in. 12s., 1¼ in. to 2 in. 12s. Stud cables, proved as required by the new Act of Parliament, ⅞ in. 15s., 15-16 14s. 9d., 1 in. 14s. 6d., 1⅛ to 2 in. 14s.; common anchors, 1 to 2 cwt., 16s.; 2 to 3 cwt. 15s. 6d., 3 to 5 cwt. 15s. 3d., 5 to 20 cwt. 15s., 20 to 30 cwt. 15s. 3d., 30 to 40 cwt. 15s. 6d. Trotman's or Porter's, 1 to 2 cwt., 61s.; 2 to 3 cwt. 46s., 3 to 5 cwt. 28s. 6d., 5 to 20 cwt. 20s. 6d., 20 to 40 cwt. 20s. 6d. at all works, except for large lots.

ABRIDGED LIST.

Axles, 15 to 25%; coach ironwork, 10 to 15%; coach and waggon springs, 15 to 20%; Augers, 10 to 20%. **Axes.**—Ship carpenters', /5½ to /6 per lb.; Kent and house carpenters', /5 to /6; ditto, steel polished, /5½ to /7; felling axes, /4¼ to /4¾; polished, /4½ to /6; bright and blued solid steel, /7 to /8; American felling or wedge Axes, steel polished, 1/ to 1/4 per lb.; common **Anvils**, 84 lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27/ to 35/.

Basins, shallow galvanised, 10 inch, 7/ to 7/6 per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard **Bellows**, 42½ to 50%; Best extra nailed Bastard, 37½ to 45%; Best improved long Bristol, 35 to 40%; casters' or moulders', best extra nailed, 12 inch, 30/ per doz. net; common **Smiths' Bellows**, 45 to 50%; Best warranted, extra leather doublenailed, 36 to 40%; with movable pipe for shipment 2½% less discount. **Bed screws**, 6 and 7-16 and ⅜ inch, 10/6 to 11/6 per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and ⅜ inch nuts, 12/9 to 13/9; Black welded heads, 9/3 to 10/3; common slit heads, 6 and ⅜ and ½ inch, 9/3 to 10/3; Bright turned notched heads, 6 and 7-16 and ⅜ inch, 12/9 to 13/9; black notched heads, 10/6 to 11/6 per gross; **Brass head nails**, 40 to 42½%; star head, 35 to 40%; Brass plated countersunk head, 25 to 30%; **Blacksmiths' tongs**, 26/ to 28/ per cwt.; real fine wrought **Box irons**, 20 to 25%; fine cast, 42½ to 60%; middle cast, 42½ to 60%; charcoal box irons—Victoria, 45 to 50%; ordinary charcoal box irons, 55 to 70%; **Bolts**—Straight tower; solid end tower, 65 to 67½%; end Best solid tower, 60 to 65½%; solid end barrel brass knob, 60 to 62½%; japanned Scotch tower bolts, 45 to 50%; painters' brushes, 45 to 65%; Best, 10 to 40%; light galvanised **Buckets**, 12 inch, 38 lb. to the doz., 10/ per doz. net; **Blind cord**, list price net; **Bed hooks and eyes**, 50 to 55% malleable, 62½ to 67½%; Brass chain **Beading**, 30 to 35%; Brass and plate coach beading, 30 to 35%; ashpan moulding, 20 to 30%; **Bottle jacks**—Linwood's, 15 to 20%; Salter's, 30 to 35%; Nicholas's, 15 to 20%; common painted **Beams**, 35% to 65%; Bright round end beams, 40% to 55%; Bright box end beams, 40 to 55%; deep **Copper scales**, 45 to 65%; **Steelyards**, 40 to 60%; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30%; common, with round copper scale, 7 lb., 3/ to 5/; 14 lb., 3/9 to 5/9; 28 lb., 5/ to 8/ each, net; **Bedsteads**, cheap stump, 6 feet by 3 feet 6 in., 7/6 to 9/6 each; cheap French, 6 feet by 3 feet 6 inches, 8/6 to 10/6 each, rising /6 for every 6 inches. **Brass**—Rolled brass, 2 to 12 inches wide, to 30 W.G., /8¾ to /9½ per lb.; Brass sheets, 24 by 48 in., 8 lb. and upwards or 27 W.G., /8¾ to /9½ per lb.; **House bells**, brass rough, /10 to 1/1 per lb.; turned edge, /11¼ to 1/1; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3½ to 1/6 per lb.; clock bells, 1/9 to 1/10; ship and turret bells best, 1/4 to 1/5 **Battery kettles**, 150/ per cwt.; composition sheathing and **Slating nails**, /10 to /10½ per lb.; Brass **Escutcheon pins**, ⅜ by 16 inch, W.G., /10 to /10½. **Brass jelly pans**, with bails, /10½ to /11; without bails, /11½ to 1/ per lb. **Maslin kettles**, cast, 4 to 16 inch, /10 to /11 per lb. **Pinpoints**, 1/3 to 1/4. Brass **Rivets** for boots, 12 to 17, W.G., /9½ to /10 per lb. Brass **Shoe Bills**, 1/1 to 1/2 per lb. Brass **Scale pans**, 1/10 to 1/11; Brass **Toddy kettles**, 15 to 20%. Brass **Tubes**, plain rough, ⅜ inch and above, /9¾ to /10 per lb. Locomotive and marine boiler tubes, seam less from 1⅜ to 4 inch outside diameter, to 14, W.G., /8 to /9.

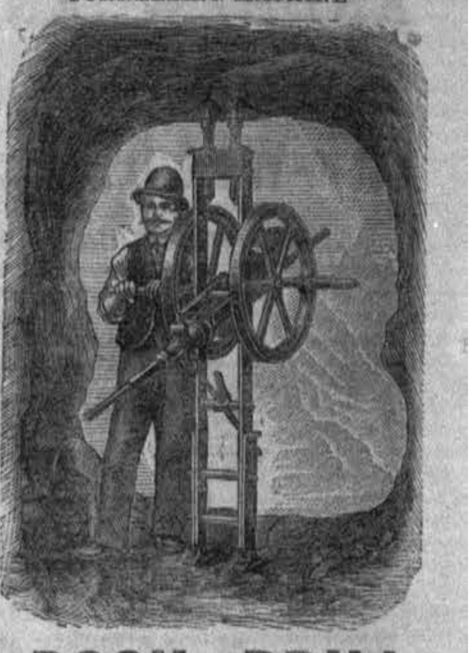
Copper.—**Copper boat nails**, wrought 1½ by 12 inch, W.G., and upwards, /10½ to 1/1 per lb. Copper 1 boat **Roves**, ½ inch and upwards 1/2½ to 1/3 per lb. Copper **Brads and bills**, same price as tacks. Light round Copper **Kettles**, bare rivets, 1/11½ to 2/ per lb. Light round covered rivets, 1/10 to 1/11½; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/3 to 2/4 per lb.; oval bare rivets raisedown, 2/5 to 2/6 per lb. Copper **Rivets** and washers, 1/ to 1/1 per lb.; Copper **Slating nails**, cut, 1 to 1½ inch and upwards, /11½ to 1/ per lb.; Copper **Scale pans**, 1/11 to 2/2 per lb.; cut Copper **Nails and tacks**, 1 inch and upwards, 1/ to 1/1 per lb.; wrought Copper nails and tack, 1/4 to 1/5 per lb.; Copper **Wire**, 0 to 20 W.G., /10¼ to /11. **Brass cupboard turns**, 45 to 52½%; **Chair webbing**, No. 9, 4/5; 10, 4/8; C9, 4/1; C10, 4/6 per gross of 66 yards; **Carpet rings** 1/ to 1/6 per gross; **Cornice poles**, 2¾ inch, brass best burnished 4/6 per foot, 25 to 35%, 3/4 covered; brass poles, 1/2 per foot, 25 to 35, imitation mahogany cornice poles with ends and rings complete, 2¾ inch, 1/ per foot; light birch ditto, 1/1 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2¾ inch, light, 2/9; middle, 3/7; strong, 4/2 per doz., 20 to 30%; wood cornice pole rings, 2¾ inch, imitation mahogany, 16/ to 18/ per gross net; light birch, 17/ to 19/; real mahogany, 22/ to 25/ per gross net; machine made wire **Chain**, single link, iron, 42½ to 47½%; double link, iron, 37½ to 47½%; single link, brass, 37½ to 47½%; registered double link,

QUARRYING MACHINE.

Hand Power Rock Drill Company, Ltd.

FOR THE
LATEST TESTIMONIALS AND REPORTS
OF PRACTICAL WORK
APPLY TO
T. B. JORDAN, SON AND MEIHE,
52, GRACECHURCH STREET, E.C.

IF PURCHASERS ARE UNABLE TO OBTAIN THE PRACTICAL RESULTS CLAIMED FOR THIS DRILL, J. S. & M. ARE WILLING TO UNDERTAKE CONTRACTS AT SAME PRICE PER FATHOM DRIVEN AS PAID FOR HAND LABOUR, AND, FAILING TO OBTAIN RAPID ADVANCE, AND TO PROVE THE ADVANTAGES OF THE MACHINE AGREE TO TAKE IT BACK.


TUNNELLING MACHINE

JORDAN'S
PATENT "DEAD-BLOW" HAND POWER ROCK DRILL
Prices, Complete, £55 to £70.
PATENT GOLD-REDUCING MACHINERY AND GENERAL MINING PLANT.

brass, 32½ to 37½%; close link brass Chain, 5 to 10% brass oval lamp Chain, 22½ to 27½%; brass Clock Chain, 22½ to 27½%; japanned pillar Chains, 1 yard, 16 by 6, 6/8 to 7/6 per doz.; japanned manger, 1¼ yard 16 by 6, 8/3 to 9/6; japanned rack, 1 yard, 18 by 6, 5/6 to 6/6, japanned dog, 1½ yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 11/ to 12/. **Cowties**, a chain, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/; close ring, 7/ to 8/ per doz.; japanned watering chains, 14 by 6, 4/9 to 5/9; tinned watering chains, 5/ to 6/; bullock chains, ⅜ inch hook at each end, 17/ to 18/ backbands, 17/6 to 18/6; short link Chain, plain or twisted, ⅜ inch, 17/ to 18/; ½ inch, 15/ to 16/; 1 inch, 14 to 16/ per cwt.; Cart and plough traces, 20/ to 21/ per cwt. **Chesthandles**, improved japanned, 75 to 77½%; broad plate, strong and extra strong, 15 to 55%, according to strength; railway **Cotterpins**, 55 to 60%; Brass **Curtain rings**, 37½ to 42½%; Brass **Chair nails**, 40 to 45%; square box **Coffee mills**, 25 to 50%; Common post Coffee mills, 20 to 30%; best brass bushed mills, 40 to 45%; London mills, 35 to 40%; registered **Coffin furniture**, 45%; Common, 70%.

Door springs, X, 75 to 80%; XX, 70 to 72½%; XXX, 65 to 67½%; XXXX, 55 to 60%; brass circular and iron circular, 55 to 60%; brass reliance, 10 to 15%; climax, 5 to 10%; universal, 50 to 60%; paragon, 10 to 15%; smiths', 10 to 15%; O'Connor's patent lever hinge springs, 10 to 15%; O'Connor's vertical spring hinge door spring, 15 to 25%; Gerish's spring hinges, iron, 20 to 25%; brass, 10 to 15%; japanned **Door chains**, 30 to 60%.

Files, 25 to 50%; **Frying pans**, best, 47½ to 52½% common, 55 to 62½%; kitchen **Fireirons**, in sets, /6 to /7 per lb.; tongs only, /6½ to /7; pokers only, /5¾ to /6 per lb. **Fish hooks**, 30 to 35%, best; common, 50 to 55%; light kitchen **Fenders**, 5 inch assorted, 2 feet 6 inches to 3 feet 6 inches, black fronts, 28/ to 29/ per doz.; bright fronts, 31/6 to 34/; Manchester pattern kitchen Fenders, 5 feet 1 inch top, black front, 2 feet 9 inches to 3 feet 3 inches, 37/6 to 41/ per doz.; 3 feet 3 inches to 3 feet 9 inches, 42/6 to 46/. Cut wire **Fencing staples**, 0 to 6, 22/ to 24/ per cwt.

Gridirons, London pattern, fluted, 62½ to 65%; light ditto, 62½ to 67½%; hanging round bar, 50% to 55%; doublet, 37½ to 42½%; round bar /1½ per bar, 57½ to 62½%; best fluted bar, 5½ to 62½%; flat bar, 57½ to 62½%; common flat bar, 57½ to 62½%; common Gridirons, /1, /1½ and /2 per bar, 65 to 70%; **Goffering tongs**, two prongs, 5/6 to 6/6 per doz.; **Gimblets**, 10 to 15%.

Holdfasts, japanned, 20/ to 21/ per cwt. **Hammers**, platelayers' keying, 31/ to 35/; miners', 27/6 to 28/6; sledge, 27/6 to 28/6; stone sledge, 27/6 to 28/6; stone, hand, 28/6 to 30/6; stonemasons' hand, 2 to 6 lb., 28/6 to 30/6; pin maul, 2 to 6 lb., 35/ to 37/ per cwt.; sledge hammers, 6 lb. and upwards, 28/6 to 30/6 per cwt.; riveting hand-hammers, 28/6 to 30/0; miners, not steeled, 22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50%; patent hasps and staples, 20 to 25%. **Cast hinges**, polished joint light patent tariff butts, 200, 45 to 50%; 333, 47½ to 47½%; 564, 35 to 40%; polished joint, best best butts, best best, 45 to 50% ditto light tariff, broad butts, 45 to 50%; best heavy, broad butts, 30 to 35%; **Patent Hinges**, edge butts, light, 60 to 62½%; strong, 40 to 50%; patent Scotch butts, 52½ to 55%; same off broad and narrow. Patent table, bed and back-flap hinges, 50 to 52½%; extra strong bed hinges, 42½ to 55%; patent chest, 45 to 47½%; patent strap, 45 to 55%. H Hinges, 40 to 55%; HL hinges, 40 to 55%; japanned and garnett hinges, double washered, light and strong, 35 to 40%; best best patent London or Lancashire tees, 57½ to 60%; patent light japanned Scotch Tees, 55 to 62½%; light patent hooks and hinges on plate and to drive, 20 to 25%; weighty patent hooks and hinges, weighty Gothic, 21/ to 26/; scolloped edges, not japanned, 22/ to 24/; Scotch japanned, Tees double washered, 20/6 to 23/6; Gothic Scotch japanned, Tees 23/ to 28/; Gothic Scotch, Tees self colour, 17/6 to 25/. **Wrought hinges**, common and best, 35 to 40%; best best, 30 to 35%; heavy wrought hinges, common black, 14/ to 16/ per cwt.; common bright, 16/ to 18/; filed edges, 17/ to 19/; japanned Gothic fancy, 16/ to 20/ per cwt. common bright, broad eye, 19/ to 22/; japanned broad eye fancy, 21 to 22/; best bright, 22/ to 24/; best broad eye, 23/ to 25/; best self-colour frog hooks 25/ to 26/ per cwt.; **Lancashire hinges** wrought, 30 to 35%; **Pressed hinges**, common, 62½ to 65%; best, 57½ to 57½%; common brass butt hinges, 1½ inch sanded, 15/ to 18/ per gross, pairs net; very light, 1½ inch, 9/6 to 12/ per gross, pairs net **horseshoes**, fullered fore, 18/ to 20/; fullered hind, 19/ to 21/; stamped, fore, 18/6 to 20/6; hind, 18/6 to 20/6. **Hollowware**, 40 to 45%; common to best, enamelled, 15 to 20%, delivered in Liverpool, London.

Ironfoundry, general.—Ash grates, 11/ to 12/, air bricks, 2/9 to 3/6, half, single, 3/6 to 4/3, double, 6/3 to 7/; bars and bearers, 9/6 to 10/6 per cwt.; barrow wheels, 10/6 to 11/6; bake pans, 9/6 to 10/6; cart bushes, 11/6 to 13/6; camp ovens, 10/ to 11/; cooking stoves, 12/6 to 13/6; cogs for blocks, 17/ to 19/; cellar grating, 10/6 to 12/6; clock weights, 9/ to 11/; Dutch stoves, 11/ to 13/; dumb bells, common, 9/ to 11/; best best japanned, 19/ to 21/; frying pans, cast handles, 12/6 to 11/6; frying pans with wrought handles, 16/ to 18/; furnaces, up to fifty gallons, /3½ to /4; galvanised furnaces up to fifty gallons, /9 to 1/ per gallon; furnace doors, 12/ to 14/; furnace grates, 9/6 to 11/6; forge backs, 12/6 to 13/6; heaters for box irons, 8/6 to 10/6; heaters for urns, 10/ to 11/; jack wheels, 18/ to 20/; oven doors and frames, 12/ to 14/; pots, three legged, Danish, plumbers', and Nego, 10/ to 12/; plumb bobs, 13/6 to 15/6; pudding pans, 13/6 to 15/; pump spouts, 14/ to 16/; sash weights, 8/6 to 9/6 ditto, with pulleys, 11/ to 13/; shoe anvils, 11/6 to 12/6; slippers 12/6 to 13/6; **Italian irons**, 35 to 50%.

Knitting pins, iron, /4½ to /5 per lb.; steel knitting pins, 15 to 24 W.G., 1/ to 2/6 per lb.; brass knitting pins, 1/4 to 1/6 per lb.; **Keys and banks**, 50 to 55%; extra strong plate, 30 to 32½%; extra strong Banbury, pin'd keys, 30 to 35%; brass shutter **knobs**, 55 to 60%; brass cupboard turns, 55 to 60%; brass drawer knobs, 53 to 60%; brass ash pan knobs, 55 to 60%; brass range knobs, 40 to 45%; **kettle ears**, 77½% to 80.

Lock furniture, brass, 60 to 65%; buffalo, 25 to 30%; china lock furniture, 37½ to 42½%; ebony lock furniture, 2¼-inch, Wilkes' spindles, 15/ to 18/ per dozen sets; sham ditto, 8/ to 9/ per dozen sets; **Norfolk latches**, common, best, 65 to 77½% common, **Suffolk latches**, 70 to 72½%; best Suffolk latches, 45 to 55%; tinned struck **ladle bowls**, 4-inch, 15/6 to 16/6; 4½-inch, 18/6 to 20/; 5-inch, 23/ to 25/ per gross net.

Netting, wire, galvanised, 57½% to 52½%, delivered **Cast nails lath**, 10/6 to 11/6 per cwt.; cast wall nails 9/6 to 12/ per cwt.; cast headed bills, ⅜ by 8 ounce, 15 to 16/; fine round cast bills, ⅜-inch, 14/ to 16/; strong round cast bills, ⅜-inch, 13/ to 16/; cast slate pegs, 13 to 17/; cast garden loops, 15/ to 17/ per cwt., all at works. **Patent wrought nails**, 32½ to 37½% per thousand and 27½% those sold as weighty by the cwt.; **patent machine-made horse nails**, 25 to 30%; **cut nails**, clasp, clout or rose nails, 3 inch and upwards, 11/ to 12/6 per cwt. Cut lath nails, 1 inch and upwards, 14/ to 15/6; cut flooring brads, 2½ inch and upwards, 11/3 to 12/9; fine cut tacks, ½ inch, 35/ to 38/ per cwt.; ¾ inch 31/6; 1 inch, 27/6 to 28/6 per cwt.; fine cut joiners' brads, or strong, 1½ inch, 16/ to 18/; 2 inch, 15/ to 17/6; 2½ inch, 15/ to 17/; 3 inch, 14/ to 15/6 per cwt.; cut shoe bills, strong, or 12 W.G., 13/6 to 15/6 per cwt.; middle, or 14 W.G., 13/ to 15/; fine, or 15 W.G., 15/6 to 16/6; fine cut tacks, per packet, 75 to 80%; fine cut brads, per packet, 62½ to 65%; **wrought nails**, long count, 15 to 20%; wrought nails, May, 1826 list, to 32½ 37½%; **wrought Bromsgrove nails**, March, 1878, list, 20 to 22½%; best countersunk clout nails 1, inch, 35/6 to 37/6; 2 inch, 26/ to 27/6; 2½ inch, 22/ to 25/6; best best countersunk and **half-countersunk horse nails**, fine best; Swedish charcoal iron, 17/6 to 19/6% list prices; wrought rose or deck-head **spikes**, 4 inch, 15/6 16/; 5 inch, 15/6 to 16/; 6 inch, 15/ to 16/; fine, /6 to 1/ per cwt. extra; galvanised, 7/ to 8/ per cwt. extra; **wrought rose nails** for India, 2 inch, 10 lb., 21/6 to 22/6; 2½ inch, 13 lb., 20/ to 21/; 3 inch, 20 lb., 19/ to 19/6; **malleable nails**, coffin nails, black, 35 to 40%; white lacquered and gilt, 25 to 30%; sacking; moulders' nails and chaplets, 1½ inch to 3 inch, 28/ to 29/; bright nuggets, 28/6 to 29/; tile pegs, 15/ to 16/ per cwt.; bright nails, 4/ to 5/ extra; tinned nails, 12/ to 13/ extra; galvanised nails, 10/ to 12/ extra; **nuts**, square forged, untapped, ¼ inch, /10 to 1/ per gross; ½ inch, 25/ to 26/ per cwt.; ¾ inch, 23/ to 24/ per cwt.; square forged nuts, tapped, ¼ inch, 1/2 to 1/4 per gross; ½ inch, 30/ to 32/; ¾ inch, 27/ to 29/; forged hexagon, untapped, ¼ inch, 1/10 to 2/; ½ inch, 32/ to 34/; ¾ inch, 27/ to 29/; forged hexagon, tapped, ¼ inch, 2/2 to 2/4; ½ inch, 39/ to 42/; ¾ inch, 31/ to 33/; machine-made nuts, square untapped, ½ inch, 20/ to 22/; ¾ inch 18/ to 20/; 1 inch, 18/ to 20/; square tapped, ½ inch, 25/ to 26/; ¾ inch, 23/ to 25/; 1 inch, 24/ to 26/; machine-made hexagon nuts, untapped, ½ inch, 21/ to 30/; ¾ inch, 22/ to 24/; 1 inch, 22/ to 24/; hexagon tapped, ½ inch, 35/ to 36/; ¾ inch, 30/ to 32/; 1 inch, 28/ to 30/.

Oddwork, tinned and black, 20 to 25%, list; **Paris pointes**, best English, 15/6 to 16/; foreign, 18/ to 20/; **planes**, 25 to 30%; iron **axle pulleys**, 1¾ inch, 12/6 to 18/; brass face axle pulleys, 28/ to 40/ per gross; B. F. and wheel, 48/ to 60/ per gross; brass escutcheon **pins**, ¼ inch to 16 W. G., 1/ to 1/2 per lb.; bright gimp pins, ¾ to 19 W. G., /6 to /8 per lb.; black, /7 to /9; brass 1/6 to 1/8 per lb. Japanned cut **gimp pins**, ¾ inch, /7 to /8 per lb.; tinned, /8 to /9 per lb.; cut clog or coffin pins, japanned, ¾ inch, /5 to /6; tinned, /7 to /8; brass pin pointes, 1/4 to 1/6; **plate locks**, fine 50 to 52½%; strong, 40 to 42½%; Lancashire plate locks, 25 to 30%; pewter measures, 30 to 35%.

Riddles, 30 to 35%; **Rivets**, iron boot rivets, /3½ to /4 per lb. patent machine-made Rivets, 30 to 35%; wrought tinmen's Rivets, 50 to 55%; round or panhead boiler Rivets, ¼ inch, 23/ to 24/; ⅜ inch, 18/ to 19/; ½ inch, 17/ to 18/; ¾ inch, 16/ to 17/. Delivered in London or Liverpool; machine-made wire Rivets, ¼ inch, 14/6 to 15/6 per cwt. **Rakes**, light garden Rakes 50 to 60%; light solid end Rakes, 47½ to 50%; bolstered teeth garden Rakes, 50%; solid end bolstered teeth garden Rakes, 40 to 45%.

Spades and Shovels, common, 51½/ to 55%; second, 35 to 40%; best 30 to 35%; best strong country Shovels; 25 to 30%; best hammered Spades and Shovels, 5 to 10%; **Ship Scrapers**, black steel blades, 45 to 50%; bright, 42½ to 47½%; cast-steel black, 42½ to 47½%; bright, 37½ to 42½%; best cast-steel black, 35 to 40%; bright, 30 to 35%; iron **Wood Screws**, 65%; brass wood Screws, 60 to 62½%; copper, 35 to 45%; Stove Screws, 50 to 57½%; dowel Screws, 60 to 65%; brass headlock Screws, 40 to 47%; gilt, silvered and plated head Screws, 40 to 45%; jute **Sash cord**, 52½ to 57½%; flax Sash-cord, 25 to 30%; best flax, 5 to 10%; super flax, 7½ to 12½%; extra super flax Sash-cord, 5 to 10%; patent steel ribbon **Sash-line**, 25 to 35%; copper **Sash-chain**, 52½ to 57½%; zinc Sash-chain, 47½ to 52½%; iron prepared, 40 to 45%, copper Sash-cord, 15 to 20%. **Sad irons**, common, 10/6 to 12 per cwt.; best japanned, 14/6 to 16/6; best best japanned, 18/ to 20/ per cwt.; **Shoe heels**, York, No. 1, 3/5 to 3/8; No. 2, 4/ to 4/3; No. 3, 8/ to 8/9 per gross net; Dundee hot turned, 5/9 to 6/3; bright-edge imperial or solid Scotch, 9/6 to 10/; bright York 61 B, 8/ to 8/6; bright solid, 6/6 to 7/; toe plates, 9/6 to 10/ per gross. **Stair rods**, turned ends, 75 to 80%; solid fancy ends, 60 to 65%; cased tube, 30 to 35%; patent solid ornamental, 35 to 40%. **Sofa Springs**, coppered, 8 by 6 inches, 25/ to 27/ per gross; 9 by 7 in, 21/6 to 23/6; 7 by 7 inches, 17/6 to 19/6 per gross; galvanised **Waterloo Scoops and hods**, 17/6 per doz.; japanned Waterloo scoops and hods, 16 inch. 15/ to 16/; japanned scoops and hods, light, 16 inch, 15 to 16/ per doz.; **Shutter bars**, common spring, broad and double, 75 to 77½%; Scotch iron drop, 77½ to 80%; brass drop, 70 to 72½%; brass drop and catch, 67½ to 70%; registered brass spring box shutter bars, 52½ to 67½%; double-handed brass spring box, 57½ to 65%; **Saddlers' tools**, 5 to 10%; **Stocks and Dies** for smiths' use, 35 to 40%; ditto for engineers, 10 to 20%; **Steel toys**, 10 to 30%.

Traps, bowspring, sham Dorset and real Dorset rabbit traps, 45 to 65%, list prices; common traps, 4 inch, 5/6 to 8/ per doz. net; run traps, 2½ inch, 4/ to 4/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/3 axle bridge, 1/4 per lb., 40 to 45%; hawk or pole traps, 54 to 56%; wrought mole traps, japanned, 2/6 to 3/9; galvanised, 3/9 to 4/9. **Tin plates**, I C, 30/ to 32/. **Tinmen's machines and tools**, 5%; brass **Bell Tube**, ⅜ inch and upwards, 1/ to 1/1 per lb.; copper bell Tube, 1/2 to 1/4 per lb.; zinc bell Tube, 45 to 50% list; **Patent cased Tube**, 45 to 50%; cut to lengths, 40 to 45%; burnished and lacquered brass tube, 30 to 35%; polished and lacquered twisted brass tube, 30 to 35%; patent taper iron tube, 30 to 35%; patent cased taper iron tube, 30 to 35%; parallel iron brased tube, 30 to 35%; twisted iron parallel tube, 30 to 35%; patent cased twisted iron parallel tube, 30 to 35%; iron **Gas Tubes**, 65 to 67½%; fittings, 67½ to 70%; iron **Water Tubes**, 55 to 57½%; fittings, 57½ to 60%; iron **Steam Tubes**, 50 to 52½%; fittings, 52½ to 55%; galvanised iron gas Tubes, 50 to 57½%; fittings, 52½ to 55%; lap-welded **Boiler Tubes**, 52½ to 55%, delivered in London, Liverpool or Glasgow; table catches, 30 to 40%; ditto, improved brass follow, 20 to 25%; wrought japanned **Tea kettles**, 50 to 60%; galvanised **Turnip skips**, 21 inches, light, 25/ to 26/ per doz.

Vices, common black, 32/ to 34/ per cwt.; common bright, 40/ to 42/ per cwt.; black staples vices, solid box black, 42 to 48/; bright, 41/ to 47/; solid box, black staple, with spherical washer, 40/ to 45/; bright 41/ to 55/.

Washers, light iron, 72½%; heavy washers, 13 to 16 lb., W.G., 12/ to 12/6 per cwt.; ¼ inch thick, 2/ per cwt. extra; 5-16 inch, 3/; ⅜ inch 4/; shook bright washers, 3/ to 3/6 per cwt. extra; **Wall hooks**, 23/ to 25/ per cwt.; **Washing tubs**, galvanized oval, 22 inch, 29/ to 30/; 24 inch, 34/ to 35/; round, 22 inch, 38/ to 40/; **Water bowls**, hammered, list price, 52½ to 57½%; light seamed 9 inch, 8/ per dozen; light wired 9 inch, stamped, 11/ to 12/; **Wove wire** list price, iron, copper and brass, 45 to 50%; iron **Wire**, bright, 0 to 6, 14/6 to 15/9 per cwt.; galvanised, 18/6 to 19/6; fine galvanised iron wire, No. 23, 5/3 to 5/6 per stone 14 lb.; annealed tinned wire No. 18, 4/ to 4/3 per stone 14 lb.; cut tinned bottling wire, No. 22, 4/11 to 5/6 per stone 14 lb.; weaving and binding wire, No. 23, 4/ to 4/1 per stone 14 lb.; bright or annealed fine wire, 23, 5/7 to 5/9 per stone 14 lb. net; cast steel wire, 0 to 6, /6½ per lb.; 10 to 20%; metallic or horticultural wire, 6 to 14, /5½ to /6½ per lb; No. 15, 5¾ to /6; 16 to 20, /5½ to /6½; in 1 lb. rings, 1½ inch diameter, ½ per lb. extra; prepared bright **fencing Wire**, 0 to 6, 14/6 to 17/ per cwt.; annealed drawn fencing wire, 0 to 6, 13/3 to 14/3; annealed drawn galvanised, 0 to 6, 17/6 to 18/6. Bright or annealed steel, 0 to 6, round or oval 15/9 to 17/9 per cwt.; black rolled, 1 to 4, 11/6 to 12/6 per cwt.; galvanised rolled, 1 to 4, 14/9 to 15/9 per cwt.

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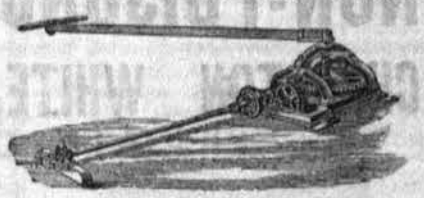

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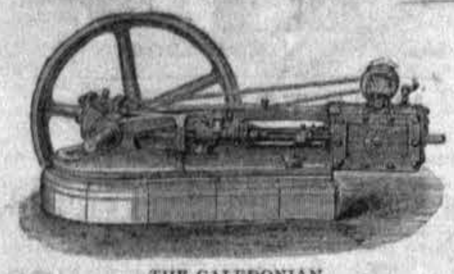
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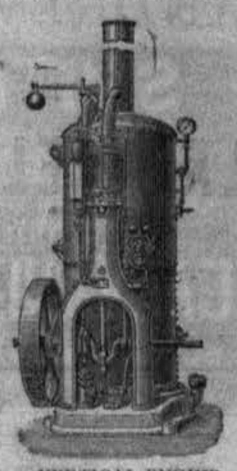
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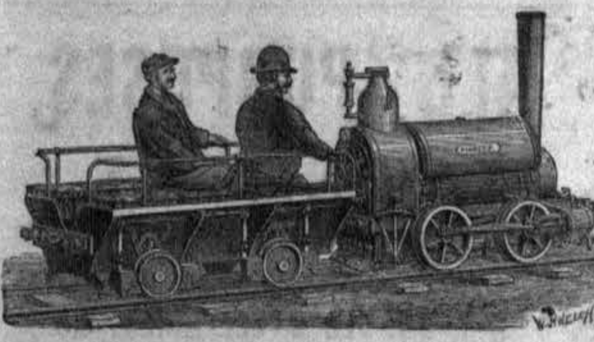
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LABOUR TROUBLES IN THE UNITED STATES.—*The Times* Philadelphia correspondent writes as follows, under date the 6th inst.:—The movements of the labouring classes of the United States for higher wages, as developed during the past week, may be thus briefly summarised, the demands of the men being in most cases granted. The New York piano-makers are all at work, having secured the increase of 10 per cent. asked. The New York carpenters have asked an advance from $2 50c. to $5 per day, and 50 employers having 3000 men have already conceded it, Fifteen hundred New York carpet-makers have obtained 10 per cent. advance. The New York fresco-painters have asked an advance from $3 to $3 50c. per day, to take effect April 14th. There are about 2000 'longshoremen on strike in New York, not so much for higher wages, as for a compliance with their trade-union rules. The strike affects several of the large steamship companies, and one or two are reported as compromising with the strikers. Five hundred of these strikers on the East River piers have been idle a month. In New Orleans the 'longshoremen are striking for an advance from 30c. to 40c. an hour. The train hands on the Cumberland and Piedmont Railroad in West Virginia have compromised and resumed work. This strike stopped coal shipments from the Cumberland bituminous region, but work there has been resumed this week. Each side made concessions. The Baltimore and Ohio Railroad on April 1st advanced all wages 10 per cent. The movement for advancing railway wages has reached New England, and the pay on the Troy and Boston Railway has been put up 10 per cent. Several strikes for higher wages are reported on the New Jersey Central Railway among the truck labourers, who do not think 10 per cent. a sufficient advance, but ask an increase from $1 to $1 25c. There has been for several days a strike of 600 labourers at the coal shipping docks at Port Johnson, New York Harbour, but the strike has just been compromised at $1 80c. per day. At the same time the wages for similar labour at the neighbouring town of Elizabethport were advanced to that figure. At the Allentown, Pennsylvania, rail mill, 200 labourers are idle in consequence of a strike by the heaters for an advance of 6c. per ton. The moulders at the mowing machine works at Hoosie Falls, near Troy, New York, have secured 15 per cent. advance. The strike at the knitting mills, at Cohoes, New York, continues partially. The employers have made arrangements with several classes of labour and have brought in outsiders to replace some others. Moderate advances of wages are generally conceded. The tailors in Philadelphia are preparing for a demand for an advance schedule of prices which if conceded, will give about 40 per cent. increase. The glass-blowers of New Jersey, involving a very extensive organisation, have all resumed work, the employers conceding most of their demands. The carpenters of Alleghany City, Pennsylvania, who have been getting $1 75c. and $2 per day, have struck for $2 50c. The furniture-makers at Reading, Pennsylvania, ask 20 per cent. advance but have not yet struck.

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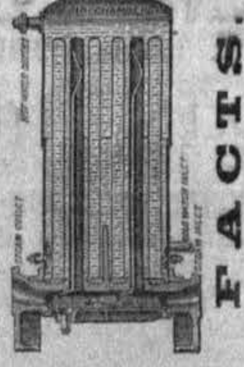
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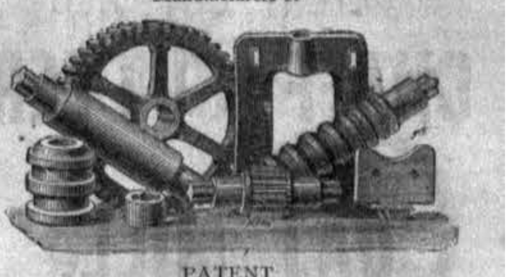
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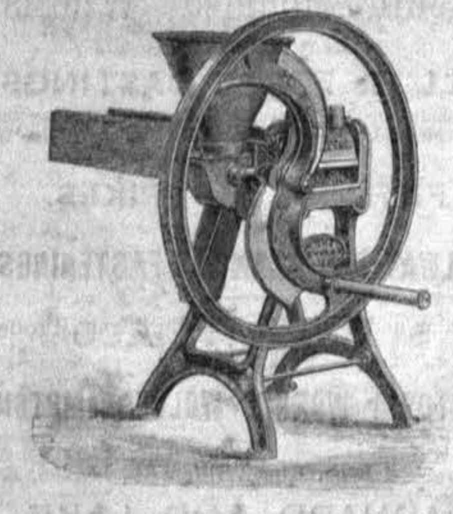

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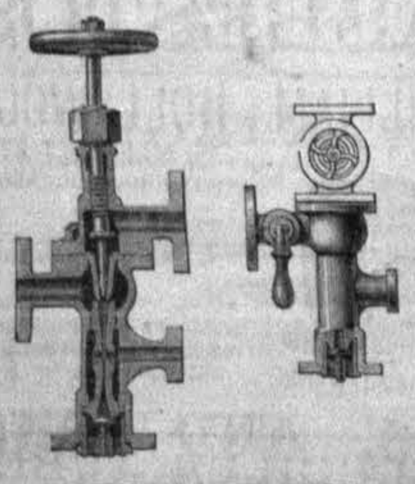

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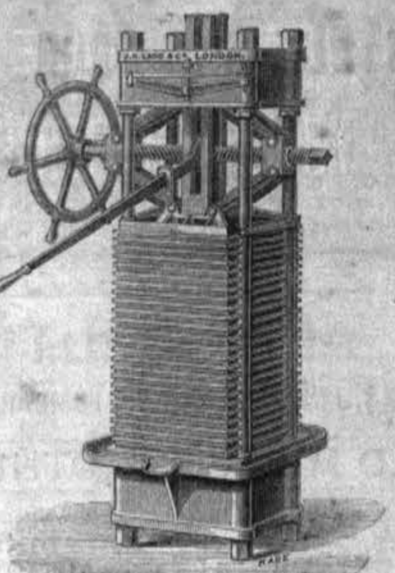

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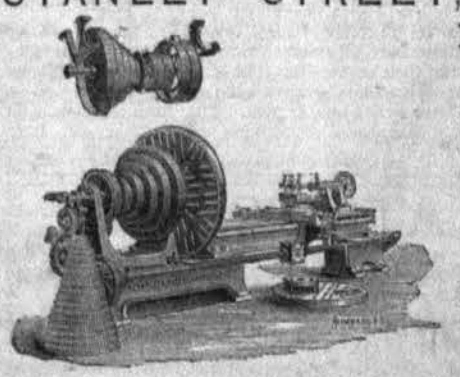

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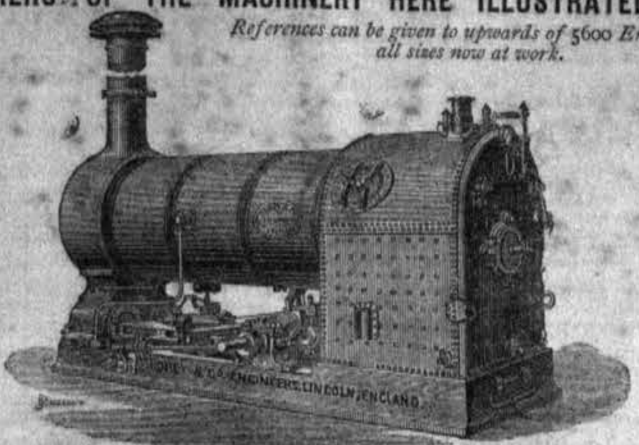
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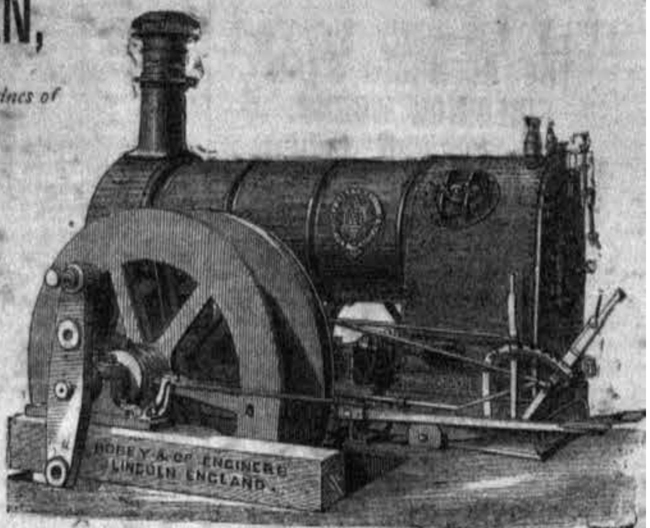
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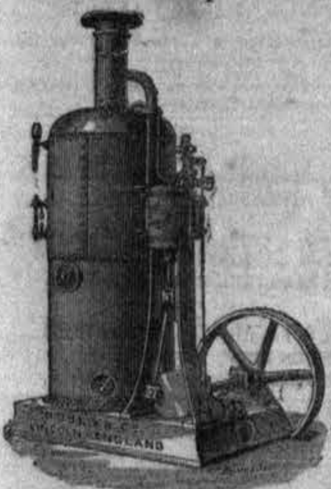

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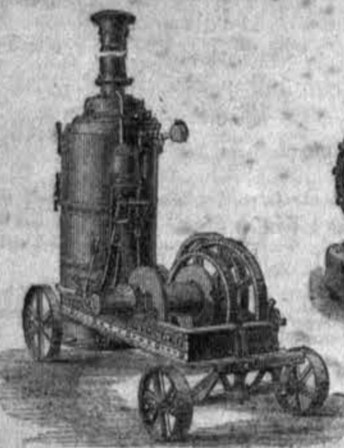

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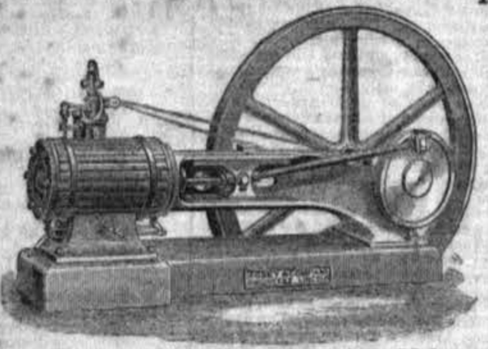

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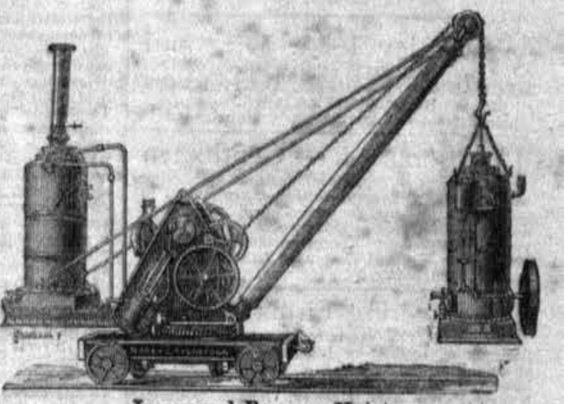

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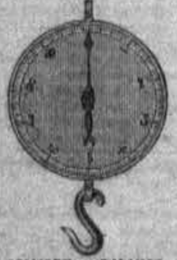

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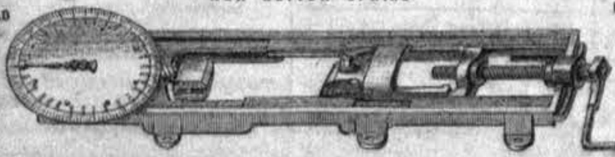

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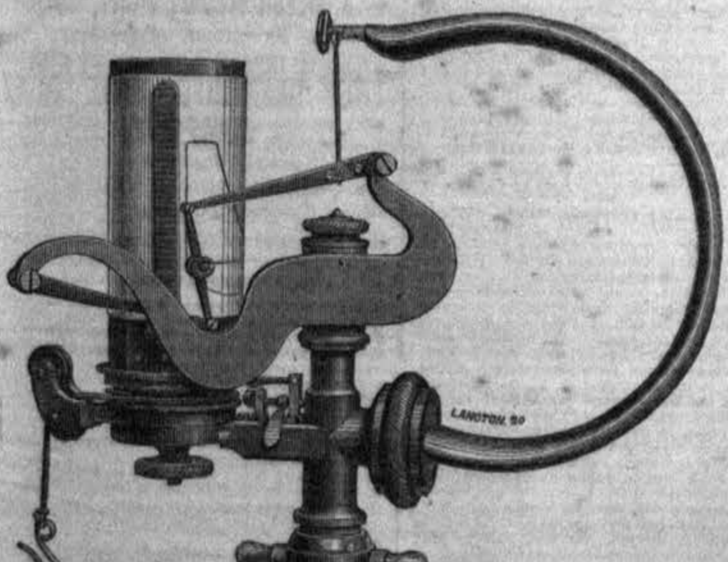

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Upset Price £30,000.—In the High Court of Justice, Chancery Division: Forster v. Forster.—Durham.—Important Leasehold Seasale Collieries, known as East Hetton and Trimdon Grange, extending under about 3600 acres, intersected by the North-Eastern Railway, and situate about 7½ miles from Durham, five miles from Ferry Hill, and 14 from the port of shipment at Hartlepool.

Mr. John Whittaker Ellis (of the Firm of Farebrother, Ellis, Clark, and Co.) will SELL the above by AUCTION, as going concerns, in one lot, at the Mart, Tokenhouse Yard, London, on WEDNESDAY, 19th May, 1880, at 2 o'clock precisely (pursuant to an order in the above action, and with the approbation of the Master of the Rolls). The EAST HETTON COLLIERY, comprising 2740 acres, includes the Town Kelloe, Kelloe Glebe, and Garmondsway Moor Royalties. The Colliery has every facility, by means of appropriate shafts, buildings, and works, and by ready communication with all the best markets by its own branch line, in connection with the North-Eastern Railway, to the ironworks of Cleveland, and to the southern markets, or to the Tyne, Sunderland, Middlesborough, and also by the Hartlepool Branch Railway, which places it in a direct route to the shipping ports for the home and export trades. The engines are of a most powerful description, capable of raising an output of 260,000 tons per annum, and there is sufficient coal unworked (it is estimated) to supply a vend for the next thirty years. The adjacent Trimdon Grange Colliery, comprising 854 acres, includes Trimdon Grange, Town Kelloe (part of), and North-side Royalties. The Colliery is situate about three-quarters of a mile from the Trimdon Station of the Hartlepool and Ferry Hill branch of the North-East Railway Company's system, and in connection with the main line at Ferry Hill. The Colliery is in first-rate working order, and is capable of raising an annual output of 180,000 tons of excellent household coal, known as Raisby South Hartlepool and Trimdon Grange Wallsend. The available unworked coal (it is estimated) is sufficient to supply a vend to the extent named for the next 30 years; also a Freehold Property, comprising a plot of land of about six acres, on which are erected 60 workmen's cottages; and about an acre of land, situate close to the Trimdon Station, on which are 33 cottages. The sale comprises a number of other cottages, erected on leasehold property, and also ample machinery and working plant. Particulars, with conditions of sale, plans, and further information may be obtained on application to Messrs. Trinders and Curtis Hayward, Solicitors, 4, Bishopsgate Street, Within, E.C.; T. W. Denby, Esq., 8, Frederick's Place, Old Jewry, E.C.; J. Anderson Rose, Esq., 11, Salisbury Street, Strand, W.C.; G. B. Forster, Esq., Backworth, Newcastle-on-Tyne; W. O. Wood, Esq. (the Viewer), East Hetton Colliery, Coxhoe, County Durham; Matthew Forster, Esq., 1 Temple Gardens, Temple, E.C. (the Receiver); R. F. Matthews, Esq., Seaton Carew, West Hartlepool; and of Messrs. Farebrother, Ellis, Clark, and Co., 5 and 6, Lancaster Place, Strand, W.C., and 18, Old Broad Street, London, E.C. Orders to view may be had of Messrs. Trinder and Curtis-Hayward, and of Messrs. Farebrother, Ellis, Clark, and Co.

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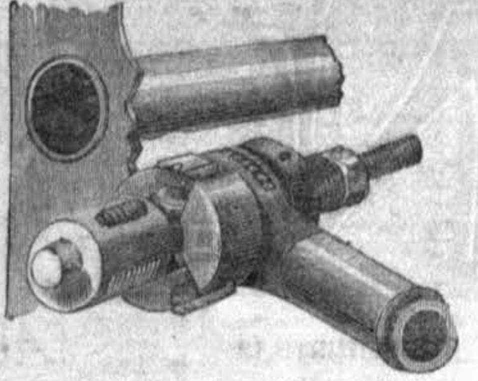

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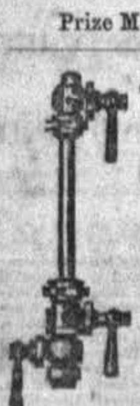

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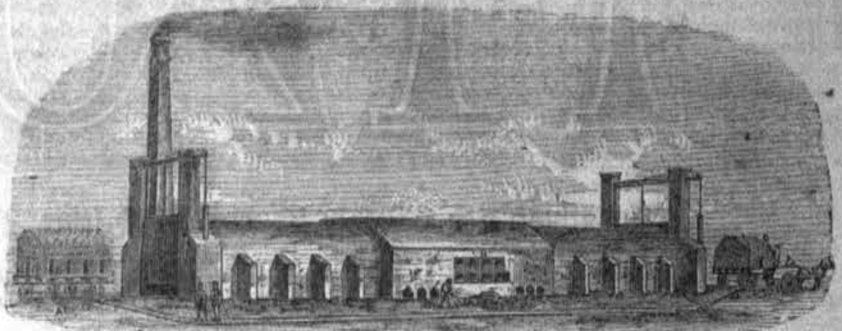

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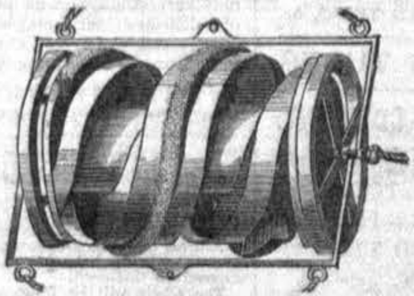

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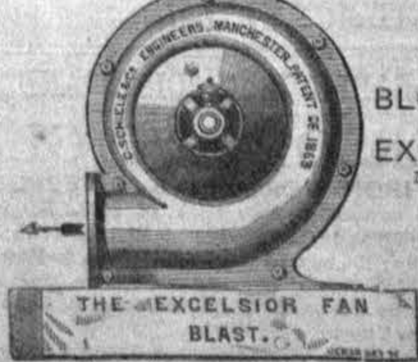

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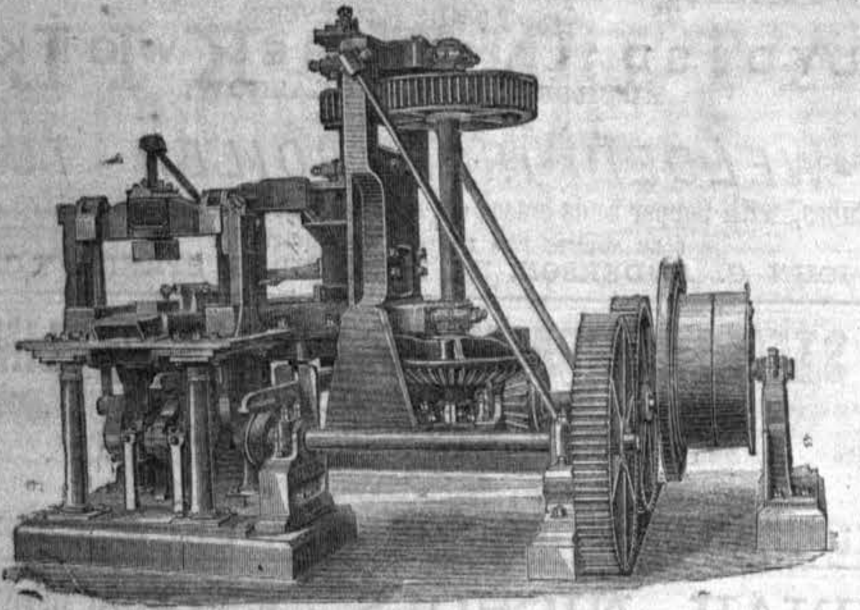

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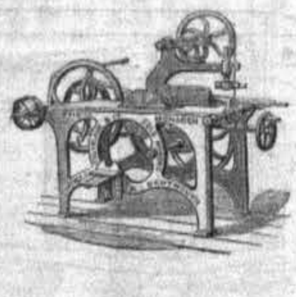

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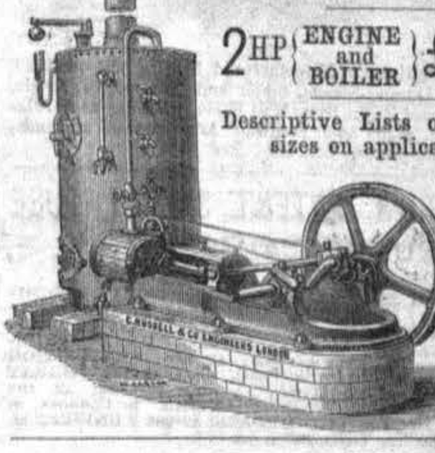
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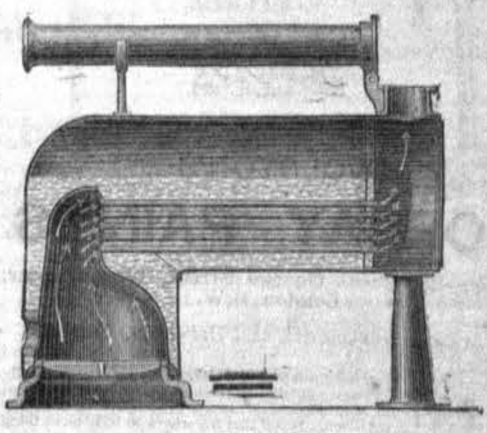

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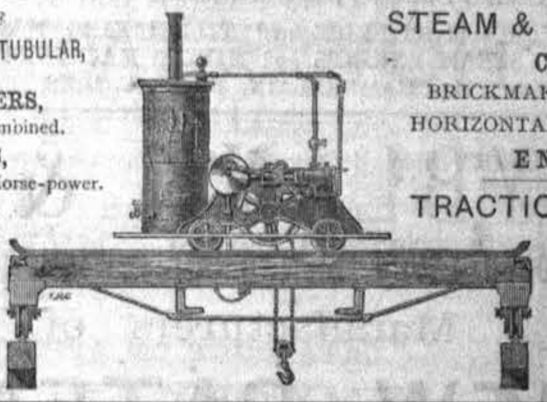

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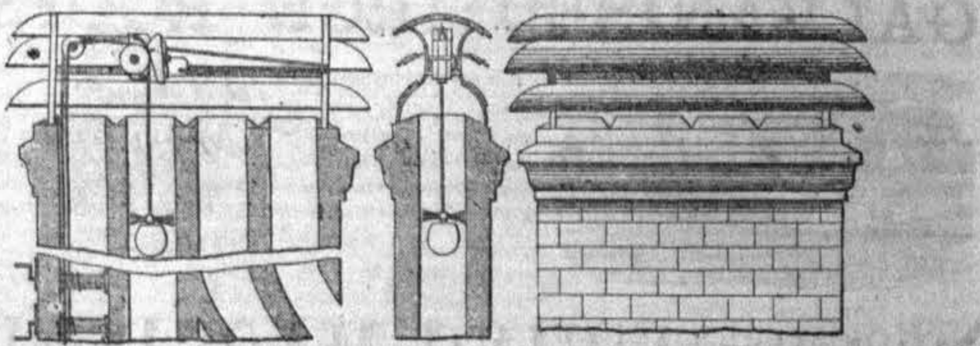

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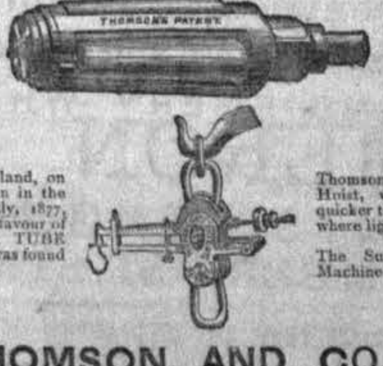

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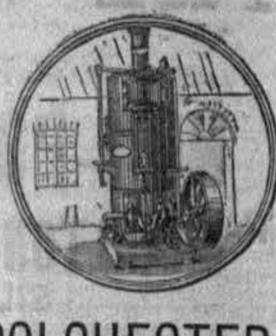

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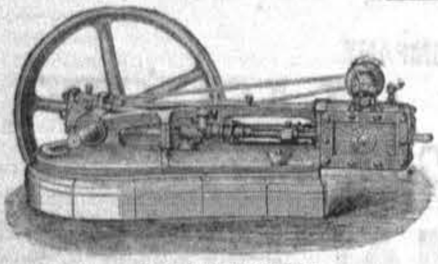

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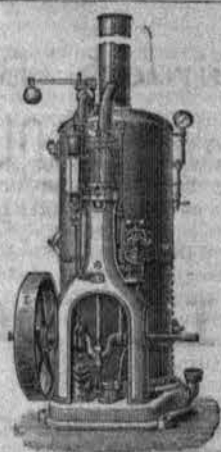

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6 × 3½	2½ × 2½	4 × 1½ = 7 ,,	6 × 2 = 11 ,,	8 × 4 = 22 ,,	10 × 4½ = 32 ,,	14 × 6 = 60 ,,	5 × 3	9½ × 3½
5 × 3½	2 × 2	4 × 3 = 12 ,,	6 × 3 = 16 ,,	8 × 5 = 29 ,,	10 × 5 = 36 ,,	16 × 6 = 62 ,,	3 × 3	8 × 3½
4 × 3	1½ × 1½	5 × 2 = 8 ,,	6 × 5 = 25 ,,	8 × 6 = 34 ,,	10 × 6 = 54 ,,	18 × 6¾ = 82 ,,	2½ × 2½	6 × 2½
4 × 4	1 × 1					19½ × 7 = 100 ,,	2 × 2	4½ × 2½
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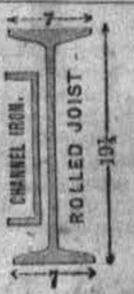

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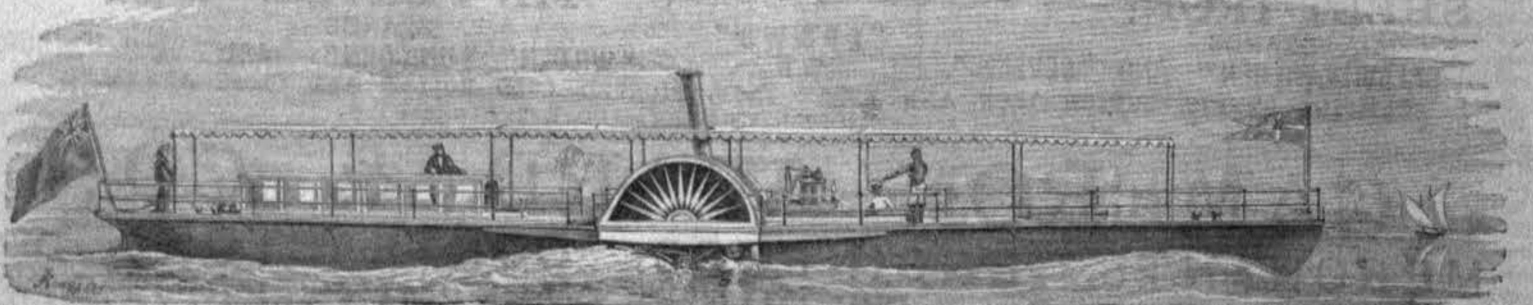

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IRON.

LONDON, FRIDAY, APRIL 30, 1880.

RAILWAY EXTENSION.

It is not unfrequently supposed that England, the birthplace of the railway system, is so well furnished with this means of communication that there is little, if any room for further extensions. Those who think thus will be somewhat surprised to learn that during last session of Parliament, no fewer than fifty-two railways in the United Kingdom promoted Bills for the construction of new lines representing an aggregate expenditure of over eleven millions sterling. Nor does the present session stand out less prominently in this respect if we may judge from the numerous railway bills deposited in view of the hoped-for Royal assent. As a matter of course some of these failed in passing the preliminary ordeal of standing orders. Others again having got over this trying period of infancy may have the bud of a promising childhood nipped by an uncompromising committee when the House gets to work again. The remainder may possibly fight their way onward to a healthy maturity, veritable illustrations of the doctrine of the survival of the fittest. But it is not so much with our own railways as with those of our Continental and colonial friends that we have now to deal, desiring as we do to place before our readers some particulars of the remarkable progress which is being made abroad in this connection.

Commencing with our nearest neighbour, France, we find that at the close of last year the Minister of Public Works projected the construction of 17,000 kilometres of new railway, of which 9100 kilometres are to be trunk lines, 2500 kilometres local or branch lines, and the remainder lines already conceded to, but not yet executed by, the different companies now in existence. It is estimated that the construction of this new system will involve an outlay of about 150 millions sterling, and it is proposed to distribute the work over a period of six years. This is the most gigantic scheme of its kind that has yet been proposed in France, and speaks well for the hopefulness and the resources of the country. Italy, following suit, proposes the addition of 3177 kilometres of new lines to its existing system. The cost is estimated at 884,000 millions of francs, and the time allotted to the work is sixteen years. The Italian railway system is smaller in extent than that of any other country in Europe, and this proposed addition will increase it by a full fourth. In Austria there are extensive railway schemes under consideration which have reference not only to the extension of her own resources, but those of the adjoining principalities. It is proposed not only to unite the Austro-Hungarian railways with those of Switzerland by a tunnel through the Arlberg, but to connect by railway the capital of Eastern Roumelia with the capital of Bulgaria, and to furnish direct communication between Salonica and Belgrade. It is expected in Servia that capital will be forthcoming for the construction of the projected line from Salonica to Mitrovitza, the establishment of this connection promises to shorten the journey to Alexandria. Russia, which has made such great advances of late years in railway construction, still contemplates further extensions, and amongst numerous schemes now either in course of consideration or being carried out, she proposes to extend the Caucasian Railway from Vladikavkaz to the Persian frontier, if the Shah will undertake to meet it there with a trunk line from Teheran. Another line has been projected from Tiflis to Teheran, and a continuation of the line from Teheran to Herat is in contemplation. Then there is the long talked of Euphrates valley railway, the most important of all the Eastern schemes, and which has long hung fire. There was a slight revival of interest in it a few months since, but the ten or eleven millions sterling required to construct the 1000 and odd miles of line involved, still remains unsubscribed, or rather unapplied for. Projects for the construction of lines from Ismid, on the Sea of Marmora, to Aleppo, and from Alexandria to Bagdad, are also under consideration.

Although these schemes indicate extensive requirements on the part of the various European States interested in them, those requirements appear to fall very far short of those of Asia and America. India, with something approaching 8000 miles of railway already opened is demanding further extensions which are greatly needed for the full development of the country. And there is encouragement for the investment of capital, seeing that within the last five years the receipts of the Indian railways have increased from £3 2s. 4d. to £5 5s. per cent. on the capital expended. China was almost persuaded to become civilised in the matter of railways by the construction of the little Woosung line, but it proved too much for them, and they ungratefully turned their backs upon it, and would none of it. Japan, however, in the matter of railways, as in many other things, has set an immeasurably better example. Lines have already been constructed from Yokohama to Tokio, from Kobe to Osako, and from Osako to Saikio, and a prolongation of the line from Tokio to Tagasaki is now under consideration. Another line between Kioto and Otsu has recently been sanctioned, and will probably be completed within the next three years. It is true that Japan is not blessed with an inexhaustible exchequer, and that Europe furnishes the greater part of the capital required for the Japanese railway system. But if the country is deficient in immediate means, it has extensive resources and a very large population, composed of those who are fully alive to their own interests, and well aware of the importance of railway communication.

Turning to our Australian colonies we find ample room for railway extension in the future, In Victoria, there are only 1112 miles of railway yet constructed, but this very inadequate mileage is now being increased. In Queensland, the central line is being extended for 170 miles westward from its present terminus, and in New South Wales, where only 600 miles of line have yet been constructed, a further 217 miles are now in course of construction, while it is anticipated that the extension projected to Hay and Wentworth will eventually be connected with a line to Adelaide. A new line from Port Darwin to Pine Creek, a distance of 132 miles, is being promoted by the Australian Government, and in Western Australia the New Eastern Railway, now in course of construction, is only the beginning of a general system that will connect the eastern agricultural districts with the city of Perth.

It is, however, in America, the land of all that is extensive and progressive in construction, where railways have been sown broad-cast, and where further mighty extensions are still being developed. At the commencement of last year the railways of the United States measured 81,841 miles, of which 29,000 miles had been made during the previous five years. At the close of that year, according to an American authority, a greater length of new track had been laid in the United States than during the corresponding period of any year since 1873. And that which is already done may be considered as only a fraction of the work actually decided on. The Texas and Pacific Company have undertaken the completion of the road from Fort Worth to the Pacific coast, a distance of 1200 miles, at a cost of over $24,000,000. The Kansas Railway Company are constructing 665 miles of new line; the Northern Pacific, 400 miles; and the Central, Eastern, and Southern lines have extensions in hand that will represent during the next twelve months an aggregate outlay of at least twenty millions sterling. Altogether, at the present time, there are about 15,000 miles of new railway surveyed and under construction in the United States—a mileage almost equal to the whole railway system of Russia, more than double that of Italy, and only about 2000 miles short of that of Great Britain. Not only in the United States is the development of railways being vigorously pushed on, for Canada has fairly launched the Canadian Pacific Railway, which will extend from the province of Ontario to the Pacific, a distance of about 2000 miles. The Legislative Assembly of Newfoundland is moreover promoting a line across the island from St. John's to St. George's Bay. The establishment of a corresponding service of steamers connecting the island with the mainland on the other side, would enable the Atlantic trade to be landed at and despatched from a point of North America nearly 1000 miles nearer to Europe than New York. Finally with regard to Brazil, there are only about 1800 miles of new railway in operation, but that mileage is now being increased by lines in construction, whilst further extensions are in contemplation.

It will thus be seen that there is a wide field for enterprise open nearly all over the world, and a large market for the materials required in the construction of railways, especially iron and steel, although these will not be all asked for from us. But before all the work involved can be carried out, or even entered upon, provision will have to be made for a very large amount of capital. There are altogether about 65,000 miles of new lines either in course of construction, or in contemplation, and putting the expenditure at £10,000 per mile of line open we have a capital of something like 650 millions to be provided. But this will not all be required at once, and as railways have proved themselves to be an improving source of revenue, there can be little doubt that when wanted for lines on judiciously selected routes this capital, vast as it appears, will be forthcoming in the future as similarly vast amounts of railway capital have been in the past.

OUR TRADE SUMMARY.

Although the iron trade is still in a somewhat unsettled condition, and prices remain depressed owing to the quantity of metal thrown upon the market by speculators, it is evident that there has been no real reaction from over-production or any other permanent cause, and the home demand is steadily, if slowly, extending. The anxiety of speculators to realise has kept the Glasgow warrant market very flat during the week, with constant depreciation towards the close, when there was a slight reaction, the latest quotations on Wednesday afternoon being 47s. 3d. cash and 47s. 6d. a month; buyers 1½d. per ton less. Several makers have made reductions in their quotations, but without improving the demand. There is nothing doing in manufactured iron, and no new orders coming in to replace the old ones, which are being rapidly worked off. The shipbuilding trade is looking up again, orders for six large steamers, to be built almost entirely of steel, having been received during the week, and more are expected. The engineering and ironfounding branches are fairly well employed. On Tuesday, in the Middlesborough, as in the Glasgow market, prices began to rally, and advanced 1s. 6d. per ton. Many makers, however, refuse to part with their iron under 40s. Forge continues to fetch a comparatively high price, the supply being still below the demand. Finished iron generally is looking up. In other departments there is a fair amount of business doing all over the Cleveland district. Quietness is the rule in the Newcastle market, but production continues as active as ever throughout the district of which it is the business centre. While the speculators there, as elsewhere, have been getting their fingers burnt, there is a universal feeling that the market will steady itself before long, the works continue to produce their usual output, and makers refuse to lower their rates. There has been a slight reduction in the prices of manufactured to the advantage of the shipbuilders, who are receiving large deliveries of material. Foundries and forges are, as a rule, well employed, and engine works are for the most part busy. The reports from Durham are to much the same effect, indeed, the uniform condition of the leading branches all over the country is somewhat remarkable. Notwithstanding the serious reduction in price makers continue as busily engaged as ever, in steel as well as iron. The slackening of the demand is very apparent in the hematite districts of the north-west, where no improvement is expected during the present season, although from the extent to which makers are sold forward, production goes on as actively as ever, and several new furnaces are being put in blast. There has been a very marked growth in the finished-iron trade of the district during the past half-year, notwithstanding the increased use of steel. Bessemer qualities of iron are being disposed of in some instances under £4 per ton, a great fall from the rates current only three months ago, when the same description could scarcely be had for £6 10s. Steel-makers continue busily employed on old orders, few new coming in. Shipbuilders, engineers and founders are also actively engaged. There was rather a better tone in the Manchester market on Tuesday, as compared with the previous week, but prices of pig-iron have experienced a further heavy fall. The manufactured trade is dull and inactive, but the forge proprietors of the district are busily employed, as are also cotton machinists and boiler-makers generally. There is little change in South Yorkshire; but a more hopeful feeling is reported from Sheffield. Although the market is exceedingly unsteady, there is a decided upward movement in prices, and foreign irons are very firm. Steadiness characterises all branches of the iron trade in the West Yorkshire district, and the moderate activity for some time existing is expected to continue for some time. The Birmingham local iron trade is described as inanimate; but most of the best firms in the wrought-iron trade are busy on orders obtained early in the year. The special industries of the West Riding are pretty active, and the Sheffield local industries appear also to be busy, very large shipping orders for cutlery having been received, while the file trade continues in a very satisfactory condition. There is some improvement noticeable in the Birmingham hardware manufactures, as well as a brighter outlook in the kindred industries of South Staffordshire. The coal trade shows little sign of improvement; indeed, the demand for house-coal is falling off, and in some cases that for coke also.

BANNER'S VENTILATION.

In a former article on Mr. E. G. Banner's system of sanitation,[*] we dealt with its application to sewers and house drains, for preventing the accumulation of sewer-gas. We propose, therefore, on the present occasion to confine our attention to the ventilation of rooms, houses and public buildings—the substitution of fresh air for that which has become vitiated by respiration or the combusion of lights and fires. In the ventilation of buildings, as in sewers, there must be an inlet for fresh air, and an outlet for foul air, as far removed from each other as possible, so that the entering current of fresh air may traverse the whole of the space to be ventilated, and draw along with it stale, if not foul, air that would otherwise remain in holes and corners. Nor is it sufficient merely to provide an inlet and an outlet, as a simple experiment will show. Insert two glass tubes of equal or unequal length in a bung fitting tightly the mouth of a glass jar, and fill the jar with smoke—by burning therin, for instance, paper steeped

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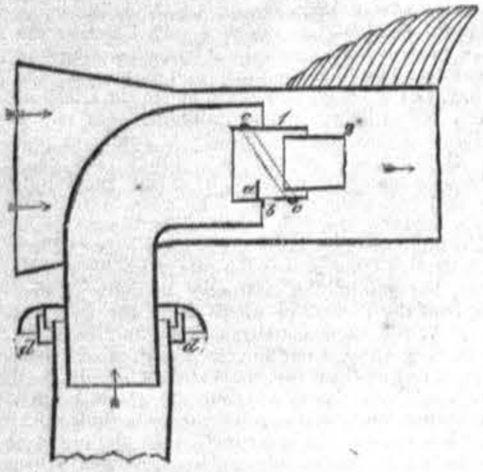
[*] Vide Iron, vol. xiv. p. 615.

BANNER'S SYSTEM OF VENTILATION.



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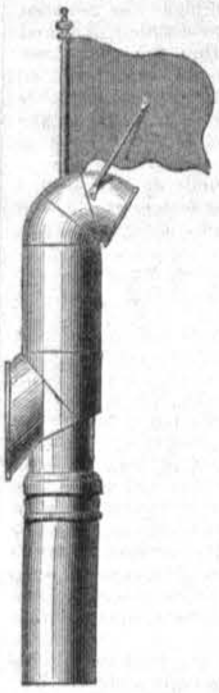

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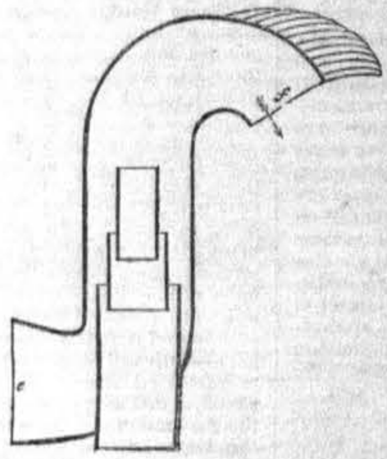

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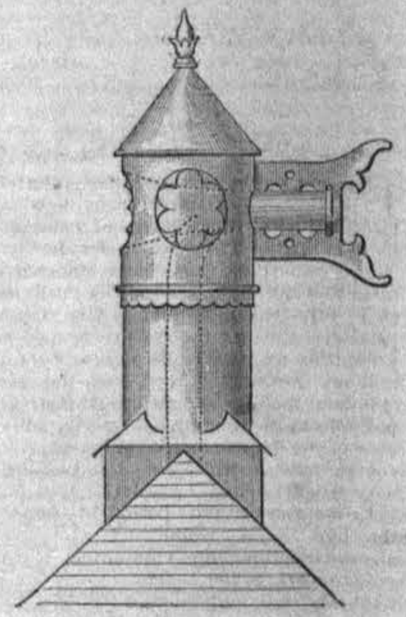

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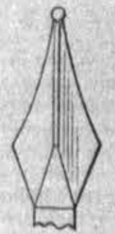

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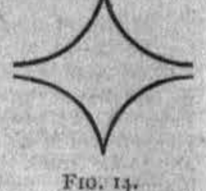

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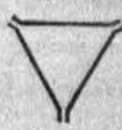

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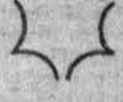

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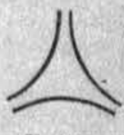

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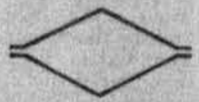

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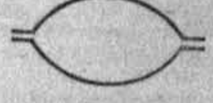

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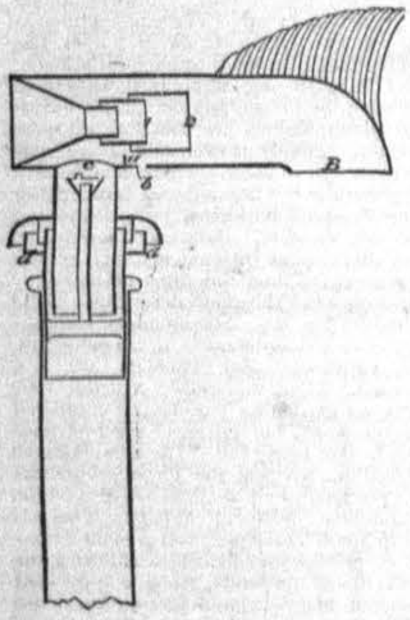

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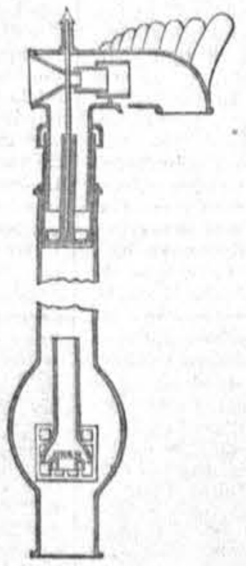
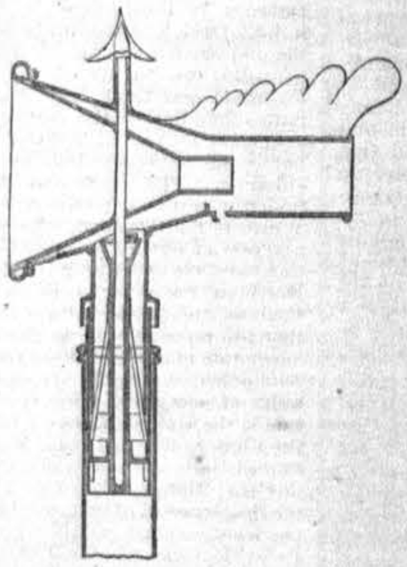


Fig. 6



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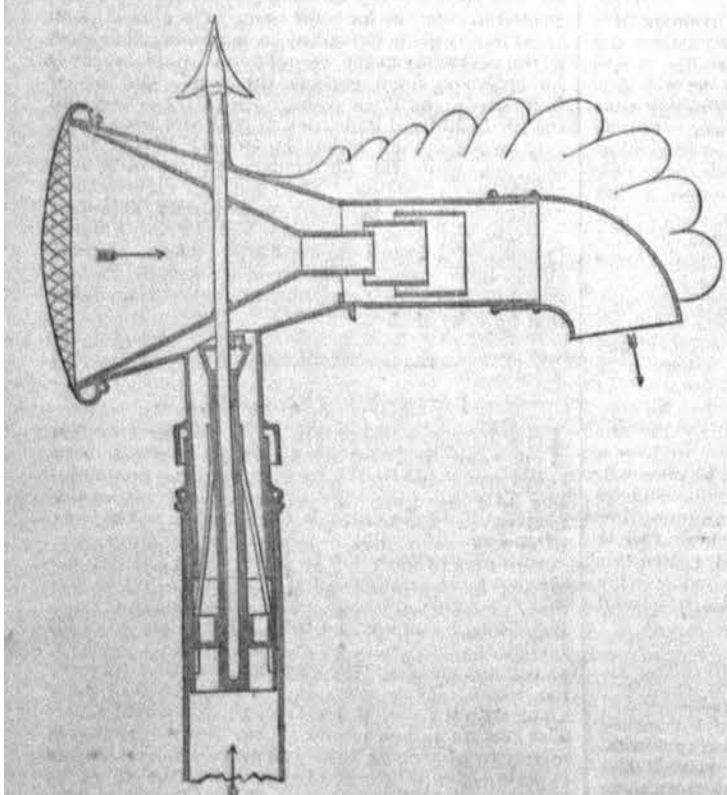

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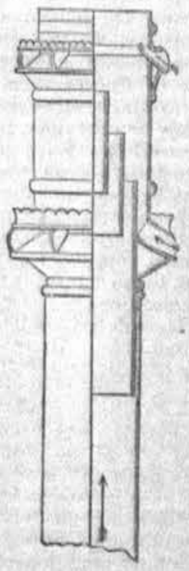

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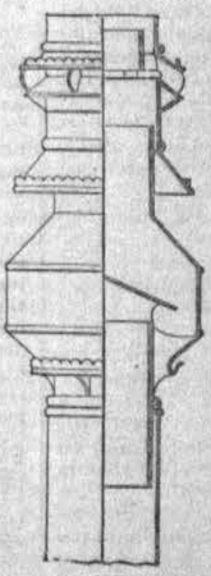

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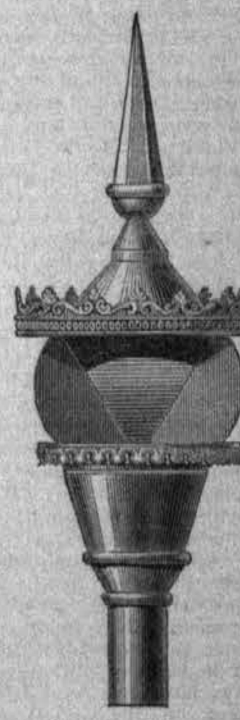

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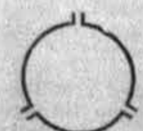

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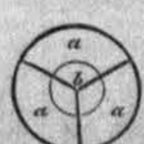

Fig. 20.

BANNER'S SYSTEM OF VENTILATION.

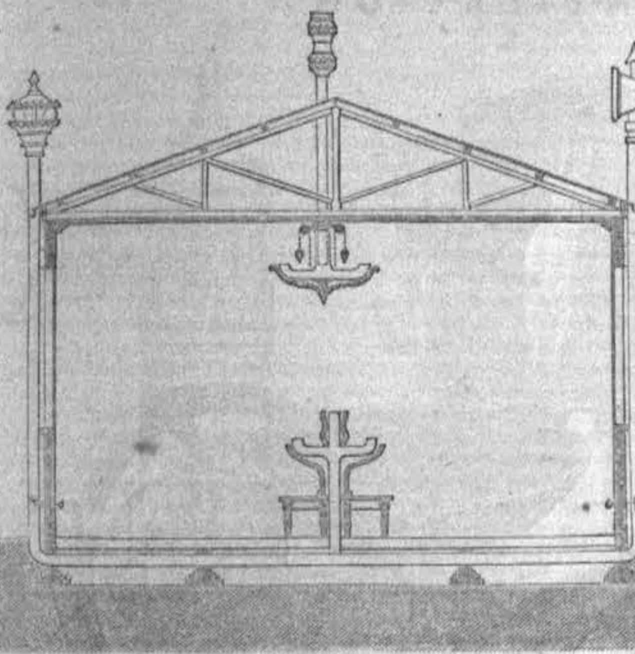

Fig. 21.

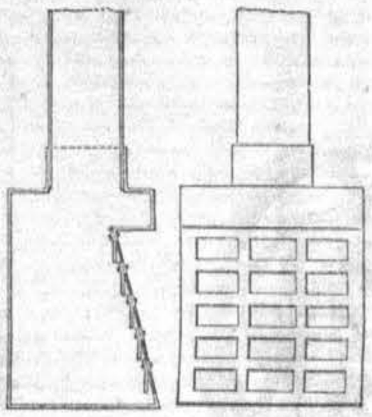

Fig. 22.

in a solution of saltpetre. While the paper is burning, the smoke will probably escape owing to the rarefication of the air inside; but, when combustion has ceased, instead of the air passing down one tube and up another, as people seem to imagine it ought to do, the smoke will remain in the jar, being also, to a certain extent, compressed and kept down by the superincumbent pressure of the heavier external air. This experiment affords a practical demonstration of what passes—or, rather, does not pass—in an apartment supposed to be ventilated by merely providing one or more communications with the external atmosphere. Now, apply any force to one tube—blow down it, for instance—and the air will speedily be changed; or diminish the pressure, even in a small degree, from one tube, and the result will be the same. This shows that for the ventilation of a room—that is, the replacing of its foul air by fresh—some motive power is necessary in addition to the inlet and outlet. In the Banner system, this motive power is supplied by the natural force of the wind passing through the cowl, and causing an induced current after the manner of the Gifford injector. It is true that the wind does not blow with constant force; but it may be safely asserted that this force is generally in excess of all practical requirements, and its effect may be modified by valves, &c., so as to give the amount of ventilation desired.

We have already illustrated* the original form of cowl designed by Mr. Banner, and will now describe some modifications and improvements that have been suggested by practical experience, extending now over nearly six years. Fig. 1. of the accompanying engravings shows a revolving cowl fitted with what the inventor calls "drums," marked 1 and 2, for intensifying the effect of the wind blowing in at the bell mouth of the cowl, which is kept towards it by the vane at the tail end. The wind, being compressed in the annular space between the two tubes, owing to the force with which it enters, and again expanding after having passed that space, induces a current up the vertical shaft, as in the original arrangement; but the action is intensified and accelerated by the "drums," one or more of which are added according to the size of the cowl. In order to prevent any rain that may beat in from descending the shaft, the drums are slightly contracted towards their outer end, and a crescent-shaped stop, *a*, is added, with a hole, *b*, for carrying off any water that may have got in, while an inclined bead, *c*, favours the same object. The cowl revolves on a central spindle, not shown in the diagram section, and the guard works in a chamber *d*, that may be filled with glycerine or any fluid not liable to freeze or evaporate, so as to form a perfectly tight joint—not, however, that this addition is by any means necessary to the proper working of the cowl. Fig. 2 shows an elevation, and fig. 3 a diagram section, of a similar cowl arranged vertically, *e* being the inlet and *f* the outlet of the wind causing the induced current up the shaft. This form is for use where the proximity of some object, such as a weathercock, might prevent the rotation of the horizontal variety. The exterior may have any ornamental form to suit the style of building to which it is applied, as, for instance, the mediæval terminals shown at fig. 4. At the Brighton Aquarium, where the Banner system is carried out in the principal building, the cowls have, appropriately enough, the external forms of flying fish and dolphins.

Another type of revolving cowl is formed by reversing the position of the actuating and the induced currents, as shown by the diagram section at fig 5. Here the wind enters the funnel-shaped mouth and passes through the drums 1 and 2, slightly enlarged at their outer ends, and induces a current up the shaft, so as to pass out at B. The rain stop is shown at *a*, and outlet at *b*, *c* being a screw cap for closing the tubular oil reservoir in which the spindle works, and *d* the joint guard. Fig. 6 shows a complete section of the same arrangement with a cone and gas burner underneath for increasing the effect, as will be referred to below. A somewhat different arrangement without drums, but embodying the same principle, is given in section at fig. 7; and fig. 8 shows a further modification. The mouth is covered with wire network, and the outlet end is turned down, so as to prevent a down-draught when, through the wind very suddenly changing its direction, the cowl sometimes does not turn round as rapidly.

The oil-reservoir above-mentioned is arranged so as to lubricate the spindle for several years, without requiring attention; and the cowls are so carefully balanced, that an instance has rarely been known, out of the nearly 5000 that are in operation, of a cowl becoming set fast. In order, however, to meet the views of some architects, who will have no movable cowls, the inventor has devised some fixed ventilators both for the exhaustion of foul air and the introduction of fresh. Fig. 9 shows a half elevation and half section of a fixed exhaust ventilator with concentric tubes, exercising the same effect as the drums in the revolving cowls. The wind, entering at one or more of the upwardly-inclined apertures nearest to the direction from which it blows, induces an upward current through the shaft. Fig. 10 shows, in half elevation and section, a modification of this arrangement, provided with a chamber and conical cap to prevent down-draughts and the descent of rain, the vitiated air passing out through lateral apertures in the tube supporting the cap. The lower wind inlets, which add to the effect of those above, also permit of the escape of water. A very simple form of exhaust ventilator, where no great power is required, consists of a shaft terminating in a spear head with triangular section, shown at figs. 11 and 12. The wind, from whatever direction it may blow, impinges on either one or two of the sides, and, by being reflected, causes a partial vacuum in the apertures, thus inducing a current up the shaft. The same effect is also produced by shafts terminating in any of the sections shown in figs. 13 to 18.

We now come to the inverse action to the above, viz., the introducing of fresh air into a place to be ventilated, generally used to supplement the effect of the exhaust ventilator. Instead of the ordinary lobster-backed cowl, the fixed inlet ventilator, shown at fig. 19, is employed. A diagram section of this latter is shown at fig. 20, in which *b* represents the shaft, and *a*, *a*, *a* the enlarged portion divided, with the top of the shaft, into three equal parts. The wind, from whichever direction it may blow, is entrapped, as it were, and forced to descend the shaft. Thus it happens that, owing to the different construction of the two kinds of ventilator, the wind, blowing from any direction, will enter one of them, passing down into the building, and also traverse the other, inducing an upward current, and extracting the vitiated air. This is no mere theory, with diagrams simply put down on paper, and arrows to show the direction in which the current ought to go. But the really effective action of his ventilators is practically demonstrated by Mr. Banner with the aid of the anemometer, registering the speed of the inward or outward current produced. He has even drawn smoke downwards through an indiarubber tube over 60 feet long, arranged vertically, by means of one of his exhaust cowls fixed into the bottom of it, with a puff of air representing the wind blowing through it at a very low velocity, and is, we believe, ready to repeat the experiment at his offices, 11, Billiter Square, E.C., in the presence of those really interested in the subject.

Fig. 21 shows a section of a room or hall provided with both inlet and exhaust ventilators of the forms already described. That in the centre is the fixed exhaust ventilator, with conical cap shown in detail at fig. 10. It draws off the vitiated air from the upper part of the room by means of the branched telescopic arrangement, which can be shifted like a gaselier to whatever height may be found most effective. The central branched standard serves either as an inlet or an outlet, on putting it into communication, by means of the valves shown, with the fixed inlet ventilator on the left, or the revolving exhaust cowl on the right. As a means of merely affording passage for an up-current, while at the same time preventing down-draught, the valves are arranged in a manner contrary to that usually adopted; that is to say, they are hung so as to remain open while in their normal state, as shown in section and elevation at fig. 22, but ready to close on any down-draught occurring. The gas arrangement shown in fig. 6 is for providing a supplement to the action of the exhaust ventilator, to be used at such times as more energetic ventilation is required than can be effected by the wind for the time being; as, for instance, during a crowded meeting in the dog days, when the wind may be expected to have but slight velocity. An argand burner heats a metal cone fixed within the ventilating shaft, which so rarefies the air passing upwards through and around it, as of itself to determine a strong upward current from below, even though the wind exert very little power. The gas, by heating the metal cone, which presents a large surface to the ascending current, exerts far more power than it would do if acting upon the air within the larger shaft alone.

Mr. Banner has lately given an account of one of the buildings that he has successfully ventilated, viz., the Council Chamber of the Guildhall.* We will, therefore, select as an illustration another no less successful application of the system. Messrs. Ralli Brothers, one of the largest mercantile firms in the City, have offices in Finsbury Circus, the atmosphere in which, before the adoption of Banner's ventilation, became almost unbearable towards evening, owing to the many gas-burners and the consequent heat and stagnation of the air; indeed, about four out of the forty employés were generally away on sick leave. Now, however, all this is changed. The clerks are rarely absent through illness, and the atmosphere is at all times admitted to be everything that can be desired. Vertical tubes, in the form of pilasters, about 6 feet high, disposed about the offices against the walls, introduce fresh air from the outside of the building, in such a way that it is uniformly diffused without creating a draught. The vitiated air is taken off from the upper portion of the rooms, through gratings near the ceiling, by means of exhaust cowls mounted on the top of the shafts, which consist of zinc pipes led up outside the walls at the back of the building. The arrangement of valves shown at fig. 22. has been adopted; and the action of the cowls is supplemented, when required, by the gas-burner and metal cone arrangement shown at fig. 6. The vertical inlet tubes are provided with valves so that the amount of fresh air admitted may be regulated according to the requirements. As both inlets and outlets are distributed at various points, the whole body of air is changed gradually and imperceptibly without any draughts being noticed.

Besides many country mansions, the Banner system of ventilation has been carried out in the surgeon's department at the Admiralty; the Knightsbridge and Thorncliffe Barracks; Guy's, the Middlesex, and Royal Ophthalmic Hospitals; the type room of the Bank of England, the London and County and the City Bank; the Naval and Military, City Liberal and Thatched House Clubs; and, in fact, at upwards of three thousand public and private buildings in the United Kingdom. We are informed that the working of the system is perfect when it has been rigidly carried out on the principles laid down by the inventor.

The Manchester Tramway System.—The first section of the Manchester system of tramways which connects the lines already laid down in the outside districts, was opened on Tuesday. This section, which is about a mile in length, brings two lines from Stockport and Gorton into the heart of the city, and is laid down on what is known as Gowan's system, which consists of a sleeper and rail combined, simply laid on a concrete foundation. This system has been generally adopted within the city boundaries, and when the Manchester sections are completed, about forty miles of tram lines will be laid down on Gowan's method. In most of the outside districts of Manchester, however, where the lines are already laid, the Local Boards have adopted Barker's system, which consists of a continuous iron sleeper bearing a light steel rail.

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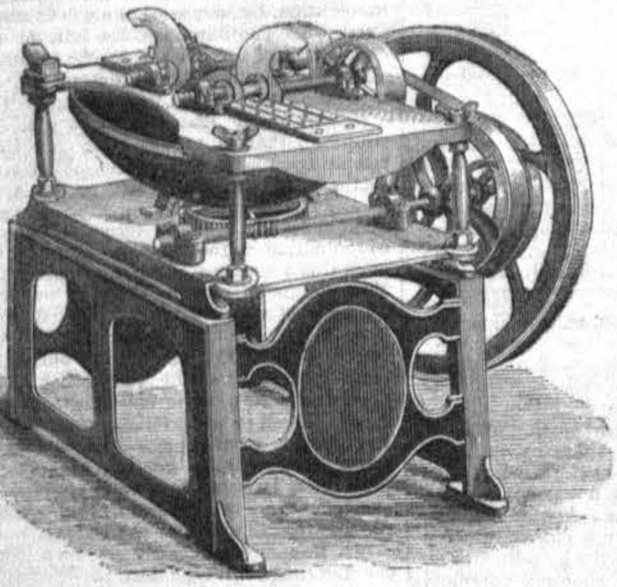
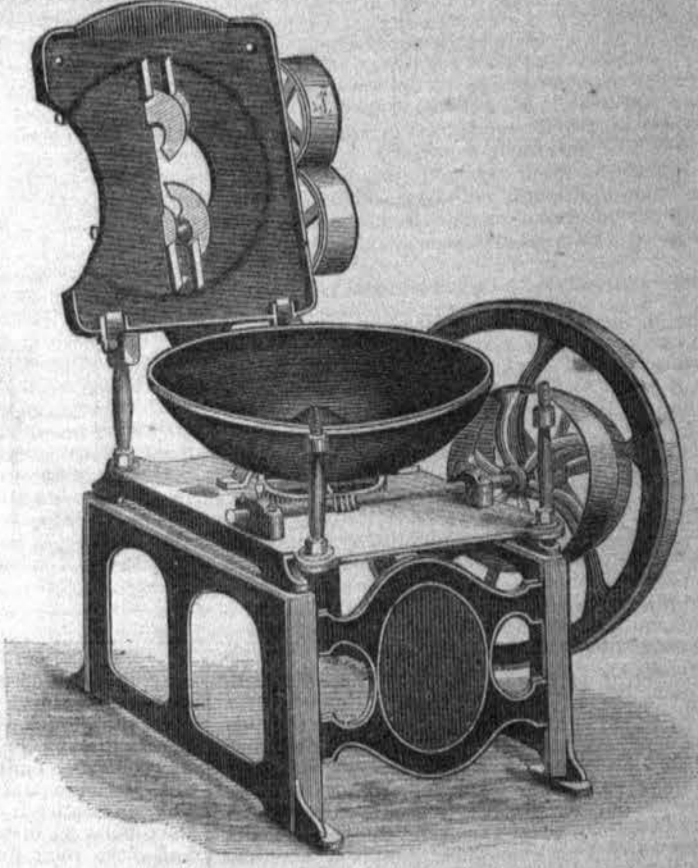
* Vide Iron, vol. viii. p. 424.

* Vide Iron, Vol. xv., p. 173.

THE "ECLIPSE" MEAT-CUTTING MACHINE.

BY MESSRS. W. AND T. OVENS.





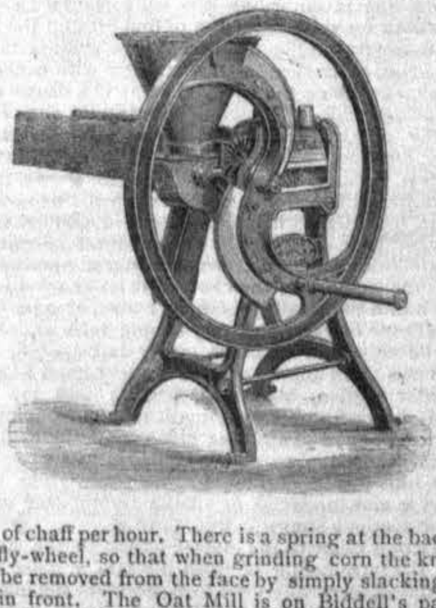
THE "ECLIPSE" MEAT-CUTTING MACHINE.

It may interest our readers to know that the days of the old noisy meat-chopping machine, immortalised by poor Tom Hood in his "Sausage maker's Ghost," are more or less numbered. At least, so we should say in view of the silent meat-cutter which we illustrate herewith. It will be seen that the meat is cut in a metal bowl, turned inside to two semi-circles, in shape resembling the curve of a ram's-horn. The bowl revolves horizontally and the knife spindles revolve at right angles to it, the knives on the spindles being set as close to the pan as possible, cutting the meat in the downward stroke and finishing by an upward cut, through fixed inverted cutters on the cover. These inverted cutters being slotted allow the meat to fall into the bowl which would otherwise be carried through, provision being made on the most convenient side of the cover to feed the machine or to take out the meat while the machine is in action. The special recommendations of this apparatus are that it cuts more thoroughly and cleaner than any other machine, thus preserving the glutinous fibre of the meat and leaving no stringy substance; that it is a perfect self-mixer, and that it is almost silent in its action as compared with the old chopping machine. It is of simple construction, and having so few working parts the cost of repairs is estimated to be very small. Vibration is reduced to a minimum and no expensive foundations are required. It is reasonable to assume that accidents will be far less likely to occur to users of these machines than with any others, there being no cranks, connecting-rods, knife carriages, or blocks, from the failing of which so many accidents have taken place, especially that which is said to have happened to the unfortunate Mr. Brain in the poem already referred to. To complete this list of advantages we may add that waste is prevented by an arrangement on the top of the cover, consisting of two slides which can be withdrawn and re-placed while the machine is in motion. The machine was recently put to a severe test in the presence of a number of those interested in the trade which it is designed to benefit, the results being thoroughly satisfactory, although the conditions of work were quite exceptional. The patentees and manufacturers are Messrs. W. and T. Ovens, of 54, St. John Street, London, who have had considerable experience in the production of this class of machines.

THE BLOCK SYSTEM.—From a return presented to Parliament by command, and issued on Tuesday, it appears that 7573 miles, out of a total mileage of 9509 of double line open on the railways of the United Kingdom in 1879, were worked on the absolute block system, or 80 per cent. As compared with the preceding year this was an increase of 3 per cent.

THE "DUPLEX" CHAFF-CUTTER AND OAT MILL.

The accompanying engraving represents a new combination implement which has just been brought out by Messrs. Hunt and Tawell, of the Atlas Works, Earls Colne, Essex. It is a chaff-cutter and oat mill in one, and is designed to meet the requirements of those who may keep two or three horses, and who have but little space at their disposal. To such it will prove valuable, as it combines in one compact machine the two most essential requirements of the stable. The Chaff-Cutter has a rising mouth 8¼ by 3 inches and will cut about 2 cwt. of chaff per hour. There is a spring at the back of the fly-wheel, so that when grinding corn the knives can be removed from the face by simply slacking the nut in front. The Oat Mill is on Biddell's patent principle, which is well known; it is fitted with a capacious hopper, and will crush from 2½ to 3 bushels of oats per hour. The gearing is enclosed within a cast-iron cover. The machine cuts chaff in the usual manner, and will kibble oats on reversing the fly-wheel. Messrs. Hunt and Tawell have another machine in course of construction, which they have christened the "Triplex," and which will be fitted with a double roller, for crushing beans and maize as well as oats.



A CLEVELAND dispatch, dated the 14th inst., says that inquiry among men heavily interested in Lake Superior iron mines shows that the season's contracts call for 1,650,000 tons of ore from that region; 450,000 tons will go to Lake Michigan ports, and most of the balance will come to Cleveland and vicinity.

OCCASIONAL NOTES.

THE METROPOLITAN WATER SUPPLY.

In Colonel Bolton's report for March a considerable improvement in the condition of the London water supply is shown over that for February, in considerable part, however, owing to the improved state of the river. All the companies are more or less actively engaged in extending their works to meet the increasing demand and in improving their filter beds. Wells are also being sunk in the chalk and more superficial strata, and there has been of late an extension of constant supply by all except the Grand Junction. The Kent Company have constructed a covered reservoir at Farnborough to hold 1,400,000 gallons, the reservoir capacity of the West Middlesex has been increased by more than thirty-four millions, the East London have formed a large tank at Buckhurst Hill capable of containing 7000, as a reserve in case of fires at night, or at other times when the engines are not at work, and the Grand Junction Company have completed the construction of a storage reservoir at their Hampton Works, to contain 45,000,000 gallons of water uncontaminated by floods, and have commenced at these works the construction of three filters, capable of filtering 11,000,000 gallons a day, with a covered reservoir to contain 200,000,000 gallons. The Lambeth Company are busily engaged at Thames Ditton in making new filter beds, which, when finished, will increase their total area of filtering surface to about eight acres, and give them the power of efficiently filtering their water at all times. With regard to a purer auxiliary supply, this company, with perhaps greater needs in this respect than the others, have sunk a well into the chalk at Thames Ditton, estimated to supply from one to one and a half millions of gallons a day. Another boring was made at the company's works at Molesey last year to the depth of 426 feet. These waters, mixed with the water from the Thames, together with that obtained from the gravel beds at Molesey, form an auxiliary daily supply of about 12,000,000 gallons, and the putting down of wells into the chalk, both at Molesey and Ditton, is under consideration. The New River Company are also sinking another well in the chalk at Enfield. Other extensions are in progress, the companies evidently making every exertion with the view of putting their houses in order in preparation for the next parliamentary campaign.

THE RAILWAY ACCIDENTS RETURN FOR 1879.

According to the annual return to the Board of Trade of railway accidents last year the dead were fewer by 38 and the wounded by 230 than in 1878—the totals for the former year being 1032 and 3513—quite enough in all conscience, and if we add the number of those killed or injured on railway premises, but by accidents unconnected with the movement of railway carriages, these totals are brought up to 1074 and 5328. The reduction is chiefly in connection with collisions, which were 154 in 1879 against 179 in the previous year, with which possibly the extension of the block system is to some extent to be credited; 504 persons were killed on the line, and nearly a thousand injured from other causes than accidents to trains, a good many of these doubtless at level crossings; and 444 servants were killed and 1833 injured while engaged in their stationary duties, most of these also, in all probability, from preventible causes, as in coupling and uncoupling carriages and other operations which are conducted under circumstances of unnecessary risk. There were 1227 failures of tires and 416 of axles, but the injury from those accidents was slight; ten failures of tunnels, bridges, viaducts, &c., occasioning the death of seventy-three passengers and three servants; fifty-eight cases of trains running through gates at level crossings, and twenty-one of trains running into stations at too high speed with very serious results.

THE PROPOSED PARK AT NIAGARA FALLS.

One of the grandest spectacles in the world, as every one knows, has been for some time in the way of losing much of its picturesqueness by the destruction of trees and the erection of often unsightly buildings, intercepting and vulgarising some of the finest views of the great cataract. Lord Dufferin, the late Governor of the Dominion, was the first to suggest the formation of an international park around the falls of Niagara. As to their present condition, Mr. Gardner, one of the commissioners who examined into it by his lordship's direction, says—"The falls themselves man cannot touch, but he is fast destroying their beautiful frame of foliage and throwing around them an artificial setting of manufactories and bazaars." The land has been disposed of by the American Government, and the Americans know well how to exercise the land rights thus acquired. The defacing of nature is proceeding with accelerated pace. Goat Island, up to this time preserved in its native beauty, is about to be sold by its present possessor. Several schemes for its utilisation are talked of. One proposal is to build an enormous hippodrome on it; another to make it a military camping ground; a third to turn it into a rifle range, and a fourth to cover it with factories. According to the Commissioners, the beauty of the falls of Niagara, thus marred, may be restored at a very small cost. The removal of a few buildings, most of them of little value, and the replanting of the banks of the river with trees would be sufficient. The Governor-General's proposal included a suggestion that the Falls should be placed under the joint guardianship of the Governments of Canada and the United States, and it was last year referred by the United States Government to the Commissioners of the State Survey, whose report on the subject has recently been issued. They express the opinion that it would be inexpedient for the State to engage in an undertaking so complicated and costly as the proposed plan would probably prove to be if carried out. They suggest, however, that Canada and New York, acting independently, could each take possession of a narrow strip of the river bank on its own side, upon which measures could be taken to prevent the further destruction of the natural scenery in immediate connection with the Falls and for the protection of visitors from the exactions and annoyances to which they are now subjected. This, the Commissioners think, could be done at a not unreasonable cost.

COLOUR-BLINDNESS.

If, as Dr. Joy Jeffries of Boston, who has made the subject a specialty, asserts, one male in twenty-five is to a greater or less degree colour-blind, the fact must have something to do with many of our railway accidents; for the testing of the eyesight of officials is very perfunctorily effected by English railway managers. Colour-blindness may be temporary. It occurs sometimes after illness, so that the examination of persons responsible for the recognition of signals on railways and on shipboard, should also be made periodically. Actual testing is necessary because many persons partially colour-blind, learn to distinguish between, say, a red and green light by their relative intensity; but that is obviously very unsafe, except when the atmosphere is particularly clear. Although this matter, like not a few others, is slighted by those in charge of English railways, colour-testing is regularly performed on Continental lines, and it is one of those things that the general Government might well undertake to enforce. The Connecticut Legislature has recently set a good example in passing a law prescribing that the State Board of Health shall prepare rules and regulations for the examination of railway employés for colour-blindness and visual power, prescribing the methods of examination, the fee to be charged and the form of certificate; and that they shall recommend to the Governor and that the Governor shall appoint, by July next, two medical experts to make examinations and issue certificates. Before next October, every railroad company in the State must have all the men employed by them as locomotive engineers, firemen, conductors, brakemen, station masters, switchmen, flagmen, gate tenders, or signalmen examined by one of these examiners. After that time, any company employing a man without a certificate from one of these examiners shall be liable to a fine of $200 to $1000.

THE CITY COMPANIES.

According to the *Athenæum*, the Lord Mayor talks of giving three *conversazioni*, at one of which the City Companies will exhibit *some* of their records, at another their plate, and at a third the general objects of interest which they possess. The objects of most interest to the public possessed by the City Companies are their financial records—their statements of income and expenditure; and if his Lordship could only persuade them to exhibit these at a fourth *conversazione*, he would merit and receive the best thanks of the community.

MARVELLOUS ARTILLERY.

Invidious comparisons have often been drawn with regard to the greater application of human ingenuity to implements of destruction than to instruments calculated to benefit mankind; but these have, up to the present time at least, been hardly just, for there is no invention in the art of war that equals the steam-engine, not to speak of those machines employed both in the metal and textile trades which do their work much better than the deftest operative, although they neither talk nor strike. But according to the *New York Herald*, a citizen of St. Louis, one Dr. M'Lean, previously in the quack or patent medicine line, has after three years' labour and the expenditure of $100,000, constructed several pieces of artillery which, but for the fact that he has at the same time invented impregnable movable forts and floating batteries, would have made war in the future impossible. Compared with the first artillery we read of, the hollowed-out tree trunks with which the great rebel swept the angelic lines, Dr. M'Lean's guns certainly show a wonderful advance. His Pulveriser fires 1200 shots a minute, and the Lady M'Lean throws 2000 in the same brief interval. "The distinctive feature of these guns," says the *Herald* correspondent, "is that the magazines are located on either side of the deadly tubes, so that the supply of charges is continuous. The gunner has simply to move a small lever. Appliances make the adjustment at any angle very speedy, and it is so arranged that the entire gun may be whirled about on its carriage by turning a small and easily moved crank. The largest gun, and that which attracted the most attention, was the Annihilator. This is the first breech-loading gun ever made. It illustrates the principle of the lever, and the inventor says it is, beyond doubt, the most extraordinary piece of ordnance ever invented. It has twelve enormous magazines, carrying ten charges each, and, therefore, 120 charges can be delivered in rapid succession. It has a bore of two inches in diameter, and around the barrel are clustered the twelve magazines. The barrel has a rifled bore 70 inches long and screws into the breech. The magazines have the excellence that they can be charged as easily when on the gun as when off, and when in moderate use the charges in the magazines can be held in reserve for emergencies. The great gun is competent to throw shot, shell and grape, changing from one to the other at the will of the gunner. The idea involved in the construction is to be carried into other and larger guns, culminating in the Hercules, which will be a 100-ton gun, and which will be principally employed in throwing huge projectile torpedoes. These bolts are from 13 to 17 feet in length, and will weigh from 1200 to 1600 lb., and carry 100 lb. of electric powder. The scale of the inventor is to range from a pistol, worked on a peculiarly effective plan, to a gun larger than Krupp's big gun. The Besom, a 360-shot per minute gun, was fired at a target, and twelve holes, all in a line, immediately appeared upon it." The Doctor has also shot-guns capable of being fired 128 times without loading, torpedoes fired from a gun which attach themselves by magnets to the sides of an ironclad and go off by clockwork anytime in the course of a twelvemonth and a day, and shells which can be thrown twenty miles. He, or the *Herald's* correspondent, has contrived at least to throw the hatchet farther, as far as guns go, than any Yankee has yet done, capable and expert at that game above all other modern people though they be.

THE INSTITUTION OF MECHANICAL ENGINEERS.

The ordinary general meeting of the Institution of Mechanical Engineers was held on Thursday and Friday evenings last week, in the hall of the Institution of Civil Engineers in Westminster, as briefly stated in our last issue, the President, Mr. E. A. Cowper, occupying the chair. The first paper read was on Permanent Way for Street Tramways, with special reference to steam traction, by Mr. J. D. Larsen. Dismissing from consideration Mr. Train's attempts in 1861, the author observed that the introduction of street tramways, so far as London was concerned, dated only from 1869. In that year three lines were authorised, viz., the North Metropolitan Tramways, embracing the Whitechapel, Mile End, and Bow Roads; the Metropolitan Street Tramways for the Kennington, Brixton, and Clapham routes; and the Pimlico, Peckham and Greenwich Tramways, from Pimlico to Greenwich. The two latter companies, which had powers over some twenty-five miles of streets, had since been amalgamated, and were now known under the title of the London Tramways Company. Some idea of the success of tramways, and of the increasing estimation in which they are held by the public, may be formed from the fact that in nine years, up to 30th June, 1878, there had been authorised by Parliament no less than sixty-five miles fifty-eight chains of line, of which fifty-six miles fifty chains were completed and open for public traffic. The greater portion of this was double line; turned into length of single line it gives 124 miles forty-six chains authorised, and 107 miles twenty-nine chains finished. These lines, necessitating a paid-up capital of as much as £1,326,054, refer to the metropolitan district only. The growth of the system has been no less widely developed in the provinces. The total mileage of road for the United Kingdom was at the same date 346½ miles authorised, and nearly 269 miles finished and in use. This, turned as before into length of single line, gives 526½ miles, and 408½ miles respectively, with a paid-up capital of £4,035,464. The author went on to remark that the extensive patronage which tramways received from the public (nearly 150 millions of passengers being carried annually) was by no means due to the superior accommodation of the vehicles, as was evidenced by the fact that the business of the London General Omnibus Company, contrary to all expectations, was not adversely affected by them. In the author's opinion their success was mainly due to the reduction in fares and to the increased service, these two innovations having been sufficient to create a traffic which was previously non-existent. Street tramways were now so firmly establisned and had proved so great a boon to the masses that the opponents of the system, on the score of its spoiling the roads, were daily being ousted from their positions. Any improvements in the facilities for intercommunications in large towns were of such vital importauce to the industries which had created such towns that the opposition of the few must inevitably succumb to the rapidly-increasing wants of the many. The objections to a tramway on a public highway were being grappled with and overcome one by one as experience was gained; and if, ten years hence, the best constructed tramway was as far superior to the best of the present as this latter was to the original road of ten or more years ago, we should have so far progressed that opposition on the ground of interference with other interests would not be tenable. The author then proceeded to point out some of the defects in the different systems of permanent way for tramways, and some of the steps which had been taken to overcome them.

He began by describing the early systems of laying tramways, the various arrangements being illustrated by diagrams, discussing their merits and demerits as he proceeded. He then described his own improved system for steam traction, remarking that the time had now arrived when tramways about to be constructed would have to be designed for the possible contingency of using steam traction on them, even where its present use might not be contemplated. The rail is of the ordinary section known as Larsen's rail, the side flanges being punched as when first introduced for use with timber sleepers. This rail is secured to the top of the sleeper by a side fastener in the form of a hook-bolt, having one end turned round at a right angle, and the other end screwed for a nut. Between the web of the rail and the central web of the sleeper there is a filling piece of cast iron made with a slot or groove down its outer side, in which the hook-bolt lies. The hook-bolt is first inserted through the rail flange from the inside; this filling piece is then slipped up behind it, and a lock nut screwed on. The rail is thus secured to the girder in a manner as rapid and easy of accomplishment as it is secure and effective. The base plate may be made as wide as desired; but by making it wide enough to form a good broken joint with the first paving sett, ample base area will be secured for the stability of the tramway rail, being in fact nearly three times that of the earlier systems. The continuity of the rail and sleeper is secured by making rail, sleeper and base plate all break joint. Fish plates are unnecessary, inasmuch as the base plate forms an effective fish plate for the girder sleeper, and this again for the rail; The systems of tramway construction invented respectively by Mr. B. Barker, Mr. Gowan, Mr. Aldred, Mr. Winby, and Mr. Mackisson were next described in detail and explained by means of diagrams. Mr. Larsen observed that none of these methods had been long enough in use to enable a complete comparison to be made of their merits. They all possessed good qualities in different directions, and no doubt would in each case be found to remedy some of the defects with which experience had made us acquainted. The author referred throughout to steam alone as a motive power for tramways; and for the reason that according to our present knowledge it was the only available power. Compressed air answered admirably in every way except one, but that one most effectually shut it out from all competition with steam. Where compressed air was used as a motive power, principally in underground operations, it had been found by experiment that the resultant efficiency of the working engine, as compared with the air-compressing engine, rarely exceeded 30 per cent. Consequently, the difference in cost under the most favourable conditions would be as three to one against compressed air. That difference was sufficient to justify us for the present in discarding the idea of compressed air as a motor for tramway purposee. The same objections applied to the hot water or fireless engine, invented by Dr. Lamm, of America, though not perhaps to the same extent. Several modifications of that type had been tried with varying success. The chief reason that its use had not been extended was doubtless the financial difficulty; and even with steam traction it must be first satisfactorily demonstrated that it was cheaper than horse power, and it would then become practically universal. At no very distant date, in the author's opinion, horse tramways would be the exception and steam tramways the rule,—on account of the superiority of steam as regards safety to the ordinary traffic. The author was aware that just the reverse of that was now urged by many; but in that, as in everything else since the beginning of time, the majority of to-day must become, by the spread ot knowledge and the light of experience, the minority of to-morrow. With respect to the comparative cost of steam and horse-power, the first had not been in operation long enough to give reliable *data* respecting the cost of maintenance of tramway engines; and moreover, that was an item which, with improved permanent way and engines carefully designed, would be continually decreasing. The author believed that if the roads had been better in the first instance steam traction would have come more prominently to the fore than it had as yet; bnt so many men of ability and experience were now devoting their energies to the solution of the problem of applying mechanical power to tramways that its ultimate success was assured. According to Mr. D. K, Clark, the resistance to traction on a railway might be as low as 6 lb. per ton. If that were the case, the haulage of tramcars over grooved rails could never be accomplished at so cheap a rate as those prevailing on railways. In 1870 the author made a series of experiments on the New Cross tramways, using a dynamometer to register the resistance to traction; and on a level and straight road in good condition, and under favourable circumstances, the resistance was as much as 18·2 lb. per ton, or about three times the force necessary on a railway under similarly favourable conditions. The great difference in the traction on a tramway, as compared with a railway, might be in some measure due to the build of the cars, inasmuch as they had a very short wheel-base and considerable overhanging weight at either end. Engines for tramways, especially the earlier ones, had also been made usually with a short wheel-base, but latterly they had been fitted with a pair of small trailing wheels, and with very good results. doubtless some modification in this direction would take place in the wheel-base of the cars, and a decreased resistance to traction would then probably be observed. The author thus brought finally into view what, among the defects and objections admitted or supposed to exist in tramways, was the greatest of all namely the necessity of having a grooved rail, level with the surface of the road. The exigencies of the highway, however, rendered this condition an absolute necessity, and all their energies must be devoted to minimising the inconveniences which it inevitably entailed.

The reading of the paper was followed by a general discussion, in which Mr. R. C. Rapier advocated a tram-rail of sufficient width to allow a horse to plant the whole of its shoe upon it, so that it might not slip. He also observed that the wheels of ordinary vehicles wore grooves in the stone pitching, and hence another necessity for broader rails, so that vehicles of any gauge might conveniently run on them. He considered that the success of the steam-traction had been seriously retarded by imperfections in the permanent way. Mr. Arthur Paget did not agree with Mr. Rapier as to a broader rail preventing horses slipping. He thought that on a fine day, when the iron was bright, it would be more slippery than ice. Referring to the relative merits of the various systems of tramway described by the author, Mr. Lynde, of Manchester, said Barker's system was the best he had yet seen; and Mr. John Robinson, past president of the institution, expressed his belief that that system met the general requrements of the public. Referring to the use of steam on the Paris tramways, he observed that the rails there were bad, and the use of steam was consequently attended with bad results. Mr. T. R. Crampton said it would be easy enough to construct a locomotive to do the work if a sufficiently stable roadway were provided. Mr. Lister Holt observed that the want of success of steam tramways in Paris was, as Mr. Robinson had stated, solely due to the faulty rails, which were far too narrow at the base for their height. While agreeing that Mr. Barker's was a very good system indeed, he preferred Mr. Gowan's system to it, and was inclined to think that Mr. Winby's was better than either. Mr. J. Head advocated the use of iron alone for the permanent way of tramways. Mr. Price Williams looked forward to the advent of locomotives on tramways, the only question, he considered, was that of cost. The President expressed a similar opinion, observing that a light locomotive such as a tramway required was infinitely less destructive to the way than the heavily laden vans which, from the exigencies of traffic, were constantly crossing and recrossing the lines at various angles. He advocated a rail having a narrow groove. After some remarks from Mr. Larson in reply, a vote of thanks was accorded to him for his paper.

The next paper read was by Mr. William Anderson, of Erith; it comprised some remarks on Chernoff's papers on steel. M. Chernoff has been for some years assistant manager of the Abouchoff Steel Works near St. Petersburg; and before he was raised to that position, he was more particularly connected with the forge, the Bessemer process, and other operations of that establishment. He has written several papers which Mr. Anderson has translated, and has had printed for the benefit of those interested in the manufacture of iron and steel. Those papers formed the subject of Mr. Anderson's remarks, which constituted in effect an abstract of their contents, with a running commentary upon them. Mr. Anderson stated that his chief object in commenting upon Chernoff's last paper, which was on the structure of cast steel ingots, was to show the direction in which the inquiry into the hardening, tempering and annealing of steel, promoted by the Institution, was tending. He said it was of the utmost importance to elicit the opinions and to take advantage of the experience possessed by many of the members; but he felt that much time and some expenditure of funds would be needed, before the changes undergone by steel in hardening and tempering were satisfactorily explained.

The discussion on this paper was opened by the President, who observed that many years since at the Bank of England Mr. Barton made some steel buttons and ruled extremely fine lines with a diamond on the surface. The lines showed the most beautiful prismatic colours, like those in mother-of-pearl. He had also in his possession a sample of glass ruled in the same way with very fine lines, which gave perfect prismatic colours. The lines were about six thousand to the inch. Mr. J. Robinson asked for further information concerning the following statement in the paper:—"Tables of experiments are cited to show that with proper annealing in conformity with the principles laid down in 1868, cast steel is fully as tough, tenacious, and ductile as the forged metal." The members of the Institution would like to have an explanation of that statement, which was not in accordance with their experience. Mr. Anderson said the enormous difficulty of the whole subject grew upon him the more he directed his attention to it. The tables referred to by Mr. Robinson would be found in the English translation of M. D. Chernoff's paper, read in December, 1878, before the Imperial Russian Technical Society. They showed that the ultimate strength of forged steel, containing about ½ per cent. of menganese and a trace of silicon, was from 22 to 46 tons per square inch; the strength of the same after annealing in oil, was from 28 to 66 tons. The strength of cast-steel not forged was from 27 to 40 tons; and the strength of the same, after annealing in oil and tempering, was from 32 to 51 tons. Mr. Robinson inquired whether all the specimens were subjected to tensile strains. Mr. Anderson replied in the affirmative. He confessed his own impression, derived from experience many years ago, was that steel castings were not many degrees removed from cast iron in regard to brittleness. Still every year great improvements were made in the casting of steel, and therefore he had no doubt that the observations of Chernoff were perfectly right. Referring to brittle steel, Mr. A. Paget said that in Sheffield, when steel proved too brittle to be worked, it was simply put aside for six months, at the end of which time it was found to be soft enough for any purpose. At the close of the discussion a vote of thanks to Mr. Anderson for his communication was passed.

A paper was then read by Mr. Henry Davey, of Leeds, on water-pressure engines for mining purposes. After considering the difficulties of collecting and storing such a variable quantity of water as the rainfall generally and observing that it was only in very exceptional cases that the rainfall from elevated lands could be made available for power, the author went on to describe in detail two engines, which he observed, although of very limited application, presented several points of interest, particularly as, in the application of water-power, engineers were often called upon to devise special means in order to meet special contingencies. The question of applying hydraulic power economically to varying resistances had received considerable attention. A very clever and ingenious device, that of automatically altering the stroke by means of a resistance governor, had been recently described in a paper before that institution. There were other methods which readily suggested themselves, such as levers having shifting fulcrums, and similar devices; but the author had never found any such mechanism sufficiently practical for general application. A dip engine, which was fully described in this paper, might be provided with a lever having a shifting fulcrum, between the power-cylinder and the pump; but the economy so gained beyond that effected by the loose liner and change of piston, would not compensate for the extra complication. In rotary engines having fly-wheels, the admission valves of the power cylinders might be made to close at varying points in the stroke by means of known mechanisms; and if the ends of the cylinders were provided with vacuum valves opening inwards, from pipes dipping into a waste-water cistern, the speed of the engine might be kept constant, while the supply of pressure-water was varied to meet the varying resistances to which the engine might be applied. The cylinder would be partly filled from the pressure pipe, and then the remaining space would be automatically filled from the waste tank. By the use of three double-acting cylinders working on one crank-shaft, the portion of the stroke during which the pressure-water would be admitted might be considerably varied without causing a great fluctuation in the velocity of the driving column. Notwithstanding the great progress which had been made in the employment of water-pressure engines, the author was of opinion that there was a wide field still open for further application, and for the exercise of ingenuity in the perfecting of details and in securing greater efficiency. It was mainly with a view of directing attention to a power which was somewhat neglected in this age of steam that he had been prompted to bring forward this subject for discussion. After a short discussion, in which the advantages of hydraulic power were discussed, and Mr. Davey's designs criticised, a vote of thanks was accorded to the author for placing before the Institution the valuable results of his practice in the class of engines with which he has specially identified himself.

The last paper read was on electric lighting, by Dr. Hopkinson, F.R.S. Referring to a former communication on this subject, in April, 1879, the author mentioned that other observers had published the results of experiments similar to those described by him. He therefore now exhibited some of those results reduced to the form he had adopted—viz., a curve such as that shown in the "Proceedings" of the Institution for 1879, and reproduced with slight alterations. Upon the brightness of the electric arc he remarked that the light itself being different in colour from that of a standard candle, the statement without qualification that a certain electric lamp or machine gave the light of a specified number of candles was wanting in definite meaning, and he further pointed out that the omission of rays from the heated carbons and arc was by no means the same in all directions; and thus if the measure be made in a horizontal direction, a very little obliquity in the crater of the positive carbon would throw the light much more to one side than the other, causing great discordance in the results obtained. He pointed out that the success of burning more than one regulating lamp in series depended on the use in the regulator of an electro-magnet, excited by a high-resistance wire connecting the two opposed carbons. The force of that magnet would depend upon the difference of potential in the arc, instead of depending, as in the ordinary lamp, upon the current passing. Such a shunt magnet had been employed in a variety of ways. The author had arranged it as an attachment to an ordinary regulator; the shunt magnet actuated a key, which short-circuited the magnet of the lamp when the carbons were too far parted, and so caused them to close. In conclusion, the author reminded engineers of the following rule for determining the efficiency of any system of electric lighting in which the electric arc was used, the arc being neither exceptionally long nor exceptionally short: Measure the difference of potential of the arc, and also the current passing through it, in volts and webers respectively; then the product of these quantities, divided by 746, was the horse-power developed in that arc. It was then known that the difference between the horse-power developed in the arc and the horse-power expended to drive the machine must be absolutely wasted, and had been expended in heating either the iron of the machine or the copper conducting wire.

In the discussion which followed, Lieutenant Crompton observed that the length of the arc would determine the popularity of the electric light, and expressed the opinion that a good photometer was wanted. After some remarks upon the latter point from Mr. W. H. Preece and others a vote of thanks was given to Dr. Hopkinson for his paper The proceedings were brought to a close by the President proposing a vote of thanks to the Council of the Institution of Civil Engineers for their kindness in granting the use of their rooms for the meeting, which was heartily accorded.

SCIENCE AND ART.

Technological Examinations.—The returns already received for the technological examinations of the City and Guilds Institute show that over 1100 candidates will present themselves for examination at 80 centres. This is a large increase on last year, when only 202 were examined. The examinations are to be held on the evening of the 12th May, concurrently with the examination of the Science and Art Department on that evening.

Society of Engineers.—At the next ordinary meeting of this society on Monday, the 3rd of May next, a paper will be read on "The Design and Construction of the Tay Bridge," by Mr. Graham Smith, the leading features of which are as follows: A general description of the structure and the mode of constructing the piers of the large spans. The consideration of the strength and stability of the bridge. The various questions involved in restoring or renewing the bridge and rendering it safe for ordinary traffic.

Regenerative Lighting Apparatus.—Herr Friedrich Siemens, proprietor of the well-known glass works, &c., in Dresden, has lately invented a lighting arrangement in which the heat from the products leaving the gas flame is communicated to the air required for combustion and to the gas. In this way, with economy of lighting material, a considerably greater light-effect is obtained. The apparatus has various forms, of which the following may be taken as a sample:—Exteriorly, the lamp appears as a glass globe at the end of a column descending from the roof. This column consists of three concentric tubes. The innermost tube receives the gas from a smaller tube at the top, and below another small tube gives passage for the gas to the two burners in the globe. The outer annular passage is for the entering air, which comes in at the top; the inner for the products of the flame, which, rising, find a passage to the chimney. All three separate passages are furnished with wire net, or other material, which, while presenting a large surface, allow free passage for the gas, the air, or the products of combustion as the case may be. The flame products, rising through the inner annular passage, give up their heat to the wire net in this space, and most so at the lower portion. The air coming down the outer passage and the gas in the middle tube receive a portion of this heat, communicated by radiation and conduction to the wire net in these passages. Thus the gas flames are maintained by highly-heated gas and highly-heated air. The course followed by the entering air in the globe is down along the inner surface of the globe, then up to the flames. To prevent loss of heat the outer tube is enclosed in an envelope of badly-conducting material. Several other forms of lamp, on the same principle, are described in a recent number of the *Deutsche Industrie Zeitung*. Herr Siemens has set up a manufactory for these lamps, and hopes shortly to have them in the market.

"Seeing by Telegraph."—We have long produced movement, heat and light by electricity, and of late we have fallen into the way of speaking, writing and drawing by telegraph. But now, it seems, we are to see by means of what is truly the magic wire. A Dr. H. E. Licks, of Bethlehem, Pennsylvania, has invented an instrument which he calls the diaphote, and which has the power of showing, in a mirror at one end, the image of any object placed in front of a corresponding mirror at the other end. These mirrors are composed, the one of selenium and chromium, and the other of selenium and iodide of silver—substances very sensitive to light and heat. Each mirror is, moreover, built up of a number of small plates, and the corresponding couples are connected by separate wires. The receiving mirror is placed in a camera, and receives from a lens the picture of any desired object. The various gradations of light and form, falling on the plates of the mirror set up variations in the electrical currents traversing the connecting wires. These variations cause changes in the plates composing the reproducing mirror, which thereupon exhibits an image of the object. A public exhibition of this ingenious instrument took place very recently at Reading, in the United States. The receiving mirror was taken down to a room below the hall in which the spectators were assembled, and various objects, such as an apple, a penknife, a dollar, a watch, part of the printed handbill, &c., were successively placed in front of it, and immediately became visible to the audience; and when, at length, the head of a live kitten was thus seen by telegraph, the enthusiasm of all present was wrought up to frenzy. This reads well, and in the interests of science we hope it is all true. We remember, though, that a year or so ago some experiments of an analogous nature were tried in the south of France, and an opinion was expressed that it might soon become possible to take photographs of objects at a distance by means of electric currents and sensitive mirrors.—*York House Papers.*

The Diver Fleuss.—Mr. Fleuss is exhibiting at the Royal Aquarium, Westminster, in the large tank built for the whale, and used by the seals. His remarkable performance under water was better seen than it has been elsewhere, either during the few months of the exhibition of his apparatus at the Polytechnic or at Brighton. He can stay under water for five hours without an air tube or any other communication with the surface; and this absence of incumbrance gives him much greater freedom than other divers possess. Foreshortened in the water, he presents a curious appearance, with great goggle eyes in his burnished helmet, a strong water-tight dress, and water-boots. The spectators amuse themselves by throwing pence for him to pick up, or by writing messages to him on cardboard, which he reads and answers on cardboard, always under water. He sharpens his pencil under water, gives and receives signals with a cord, and is to experiment on the submarine use of the telephone. At Ryde he walked for a quarter of a mile under the sea; at Brighton he went down in five fathoms by the Chain Pier in rough weather. If he could eat under water, Mr. Fleuss says he could stay for a longer period than the five hours which he gives as the ordinary limit. The other day he remained two hours and seven minutes under water in the Aquarium, and again went down for half-an-hour in the evening. Mr. Fleuss's method was fully described in Iron, March 19th. He carries his own supply of oxygen with him in a compressed form, and is thus enabled to breathe in an atmosphere in which there is no appreciable quantity of air at all. He states that he has gone through fire-damp (carburetted hydrogen), choke-damp (carbonic acid), and could exist in the charged receiver of a gas-factory. In the great helmet and in the hollows of his armour there is room for a certain quantity of air, and this is kept fresh and constantly renewed by a stream of oxygen, the pressure of which he regulates by a tap at will. To refresh himself he increases the flow of oxygen; and, when he requires no stimulus, diminishes it. Mr. Fleuss is a young and vigorous man, who has served in the steamboats of the Peninsular and Oriental Company.

MEETINGS FOR THE WEEK.

MONDAY, May 3.

Society of Engineers.—7.30 p.m. Mr. Graham Smith, on the Design and Construction of the Tay Bridge, its Strength, Stability. The questions involved in Restoring or Renewing the Bridge and rendering it safe for traffic.

Royal Academy.—Exhibition opens.

Royal Institution.—5 p.m. General Monthly Meeting.

Royal Institute of British Architects.—8 p.m. Anniversary.

Society of Arts.—8 p.m. Cantor Lecture. Mr. R. W. Edis, on Art Decoration and Furniture of the Drawing-room, Boudoir, Bedrooms and Offices.

Gresham Hall, Lecture.—6 p.m. Professor Ledger, on Popular Astronomy, with lantern illustrations and diagrams.

TUESDAY, May 4.

Royal Institution.—3 p.m. Mr. R. H. Scott, on Wind and Weather.

Institution of Civil Engineers.—8 p.m. Discussion on the Amsterdam Ship Canal.

Gresham Hall, Lecture.—6 p.m. The Rev. Professor Ledger, on Popular Astronomy, with lantern illustrations.

WEDNESDAY, May 5.

British Archæological Association.—4.30 p.m.

Royal Agricultural Society.—Noon.

Royal Literary Fund.—7 p.m. Anniversary.

Iron and Steel Institute.—Annual Meeting.

Society of Arts.—8 p.m. Mr. John C. Morton, on the Last Forty Years of Agricultural Experience.

Gresham Hall, Lecture.—6 p.m. The Rev. Professor Ledger, on Popular Astronomy, with lantern illustrations.

THURSDAY, May 6.

Iron and Steel Institute.—Annual Meeting.

Royal Institution.—3 p.m. Professor Tyndall, on Light as a Mode of Motion.

Inventors' Institute.—8.15 p.m.

Royal Archæological Institute.—4 p.m.

Civil and Mechanical Engineers' Society.—7 p.m. Mr. W. F. Butler, on a Small Colliery in Wales.

Chemical Society.—8 p.m. Dr. Hodgkinson, on the Action of Sodium on the Ethereal Salts of Phenylacetic Acid; and Papers by Mr. C. E. Groves, Mr. M. M. Muir, and Dr. W. Ramsay.

Society of Arts.—4 p.m. Dr. B. W. Richardson, F.R.S., on Fleuss's New Diving Apparatus. Practical demonstration of the working of the Apparatus by Mr. Fleuss.

FRIDAY, May 7.

St. James's Palace.—2 p.m. Levée.

Iron and Steel Institute.—Annual Meeting.

Royal United Service Institution.—3 p.m. Captain W. H. James, on Modern Rifle Fire.

Royal Botanic Society.—4 p.m. Garden Lecture.

City of London College.—6 p.m. Dr. Heinemann on Political Economy, with discussion.

Royal Institution.—8 p.m. Weekly Meeting. 9 p.m. Discourse. (In consequence of the illness of Dr. Spottiswoode the lecture arrangements are altered).

Geologists' Association.—8 p.m.

Society of Arts.—8 p.m. Indian Section. Mr. W. Robertson, on Agriculture in South India.

Gresham Hall Lecture.—6 p.m. The Rev. Professor Ledger, on Popular Astronomy, with lantern illustrations.

SATURDAY, May 8.

Royal Institution.—3 p.m. Professor H. Morley, on the Dramatists before Shakespeare.

Royal Botanic Society.—3.45 p.m.

Physical Society.—3 p.m.

Artists' Institution.—6 p.m. Anniversary. Address by Lord George Hamilton.

METALLURGY AND MINING.

BLAST-FURNACE WORK.

OUR contemporary the *American Manufacturer*, in a recent issue, says:—"The A furnace of the Edgar-Thomson Steel Company, on the 28th ult., surpassed even its previous unapproached output of 103 tons in a single day, the yield for the day in question being 113 1880-2240 tons. And this enormous production was not obtained at the expense of fuel, the consumption of coke being at the amazingly low rate of 1965 pounds of coke to 2240 pounds of pig-iron. The fuel was Connelsville coke. The ores charged were one-third Tafna (Spanish), one-sixth McComber (Lake Superior), one-third Pilot Knob (Missouri), and one-sixth purple ore (English). The ore consumed during the month ended on the 28th ult. yielded 54·02 per cent. of pig-iron. It should not be forgotten that this furnace is only 65 feet high and 13 feet across the boshes." Again, it says:—"In the week ended March 21, Lucy furnace, No. 1 (20 feet across the boshes), made 845 tons 1720 pounds of pig-iron. Pittsburgh furnaces continue to lead the world." Perhaps they do; but, at any rate, they are not very far ahead, as the following statement of the results of No. 1 blast furnace at the works of the Consett Iron Company, Durham, show. During the seven weeks ending April 17th, 1880, the total make of Bessemer pig-iron was 5175 tons 19 cwt., equal to 739 tons 8 cwt. per week. The percentage proportions of the different qualities were—No 1, 53·6 per cent.; No. 2, 21·1; No. 3, 23·2; No. 4, 2·1; total, 100·0 per cent. The coke consumed per ton of pig was 18·68 cwt. The pressure of blast 3·99 lb. per square inch. The height of furnace is 55 feet, and the diameter at the boshes 20 feet. The stoves are Whitwell's, and the ore used is a mixture of Spanish and Elba.

Mines Drainage in Tipton.—The Mines Drainage Commissioners for South Staffordshire propose to make a draft anew for levying a mines drainage rate for underground drainage expenses in the Tiption district of 3d. per ton on fireclay and limestone, and 6d. per ton on ironstone, coal, slack and other minerals. Mine occupiers may appeal at the arbitrators' meeting on the 8th of May.

Progress on the West Coast.—The Moss Bay Iron Company are putting forth every effort to enable them to put orders out which are coming in largely, and both iron and steel works are busily employed, and the erection of the new furnace is being pushed towards completion. The new engine-house and furnace being erected by Messrs. Kirk Brothers, are nearly completed. The brisk trade, which for some time past had been experienced at the West Cumberland Works, is fully maintained. Under the management of Mr. Harrison these works have gradually undergone a complete change. The furnaces and stoves have been renewed and given place to structures erected on the latest improvements. Everything that science and experience could suggest for an increased output has been done. A commencement has been made with the manufacture of places for steel ship and boiler plates. Goods orders are in hand, the mills being in good working order. Foundations for a third furnace are being put down at the Lowther Works; the rest of the furnaces are all in blast, the works are in full operation. At the works of the Workington Hematite Iron Company two more furnaces are being got ready with all possible despatch for putting in blast. The two furnaces at present in blast are not sufficient to meet requirements. The railway companies in this district are considering the advisability of running night mineral trains to keep the traffic from accumulating.

The Discovery of Coal in Staffordshire.—The finding of thick coal at the Hamstead sinkings, near Walsall, during the past week has occasioned much interest in South Staffordshire. The seam which has been gone through is seven yards thick, and is the same as that which has abounded in the Earl of Dudley's and other vast mineral estates of the Black Country, and is known as the old South Staffordshire thick coal. All the leading mining engineers of the district have examined samples of coal taken out of the shaft, and they pronounce it to be of great value both for domestic use and ironmaking purposes. It is the superior quality of thick coal over all other seams in the kingdom that has contributed so much to the industries of South Staffordshire and adjoining districts. Having proved the thick coal at a depth of over 600 yards, the company now propose to continue the sinking operations to prove the heather coal, new mine ironstone, and other measures, which usually lie below the thick coal, and while the second shaft is being sunk for the development of the estate headings will be driven out from the thick coal with the view of working it. The estate is over 500 acres in extent, and is about two miles from any of the great faults, and consequently there is little likelihood of any disturbance being found in the thick coal such as usually occurs in the vicinity of the faults. The company have running through their estate the South Staffordshire branch of the London and North-Western Railway, the Tame Canal, and the main turnpike road between Walsall and Birmingham.

North Staffordshire Institute of Mining and Mechanical Engineers.—A meeting of this Institute, under the presidency of Mr. W. T. Craig, M.P. for North Staffordshire, was held at Stoke-on-Trent on Monday, April 26th, when an interesting paper on Explosives and the Mines Regulation Act, 1872, was read by Mr. J. G. Bakewell. The author urged that the Act assumed that the accidents hitherto inseparable from mining were preventible by the mining engineer, and most unfairly proceeded to make him personally responsible for the whole of them. Two things were much needed—first, a light which should be absolutely safe; and second, an explosive for blasting purposes which would yield no flame. The impossibility of producing the latter ought to be demonstrated by the State before blasting was prohibited, because many of the best mines in the kingdom could not be worked without blasting. Mining engineers were justified in complaining that the existing list contained provisions which could not be carried out, such as those which related to ventilation and timbering. The words "as far as practicable" ought to be inserted. Then the provision for making owner, agent and manager all responsible was un-English. The responsibility ought to rest on the certificated manager. As one manager could not undertake the daily supervision and control of large collieries, underlookers ought to be certificated officials. Government inspectors should be required to report the result of their inspections of mines to the Home Office and the responsible manager, and not merely be wise after an accident. Differences of opinion as to management prior to an accident should be referred for investigation to a competent tribunal duly appointed. A committee was appointed to consider the subject of the paper, and prepare resolutions for consideration at the next meeting, with the view to their being laid before the Home Secretery.

RAILWAYS & TRAMWAYS.

THE SOUTH YORKSHIRE MINERS AND THE TONNAGE RATES.

GREAT efforts are just now being put forth by the South Yorkshire miners and some of the representative coalowners to obtain a Royal Commission for the purpose of inquiring into the rate of charges for the carriage of coal, iron, and other goods by rail from that district as compared with the rates and facilities which certain railway companies give to other localities. A large mass meeting was held at Mexborough on Monday for the purpose of supporting the Hull, Barnsley and West Riding Bill, at which Mr. B. Pope, chairman of the Denaby Colliery Company, and other gentlemen spoke. Although the meeting was called for the purpose named, great efforts were put forth to obtain signatures to the petition in favour of the Royal Commission. A large number of petition sheets have been distributed throughout the coalfield, and a vast number of signatures have been obtained. The promoters point out that for a great number of years they have been agitating for new lines, but these have always been opposed by the existing railway companies, and thrown out. Many years ago the Coalowners' Association London Railway Bill was promoted by the Manchester, Sheffield and Lincolnshire, and the Great Eastern Railway Companies and the Coalowners' Association (the latter of whom paid half the expenses of promotion), but it was rejected. It will also be pointed out that so long ago as 1874 an indignation meeting was held in Sheffield, on the subject of the rates and the facilities afforded to the district, and although certain improvements were promised they have not been carried out, and the trade of the district is now rapidly declining in consequence. Unable to move the directors of the several lines which monopolise the district traffic, the promoters contend that they have a right to invoke the aid of public opinion and petitioning the House of Parliament to grant a Royal Commission of enquiry. The three great companies with which they have to contend are the Manchester, Sheffield and Lincolnshire, the Great Northern and the North-Eastern. It is stated that an agreement is in existence which enables the Great Northern Company to receive the Durham coal from the North-Eastern Railway Company at York and carry it to London at the rate of 9s. 3d. per ton, a distance of 259 miles; whilst the rate from South Yorkshire, via the Great Northern, a distance of 161 miles 8s. 3d. per ton; thus Durham coal is carried 88 miles, for 1s. per ton. For some years there was a differential rate of 8d. per ton between South Yorkshire and Derbyshire, Staveley being considered the centre of the district. This has been set aside, and there is now a difference from some of the pits in the Derbyshire and Nottinghamshire coalfields of as much as 1s. 1d. to 1s. 2d. per ton in favour of Derbyshire, thus preventing Yorkshire coalowners from competing in the London market. The difference in the rates, to say nothing of the competition of seaborne coal, is highly detrimental. The promoters of the petition will, however, not rely on the London rates alone, but will doubtless point out the injustice of the rates with regard to Hull and other places. Up to about the middle of last year the rate from South Yorkshire to Hull was 3s. 1d. as against 2s. 3d. from Normanton, which is only some fourteen miles nearer Hull. Arrangements are said to exist by which the Manchester, Sheffield and Lincolnshire Railway Company charge the same rates to Grimsby. Another instance is given with respect to the timber trade, which, owing to an agreement, is kept from the port of Hull and carried from Sunderland at a lower tariff. The company having the charge of the district are said to be demanding three farthings per ton per mile for carrying South Yorkshire coal to Hull, whilst it carries coal from its own coalfields at Hartlepool at a much lower rate. The importance of the subject cannot scarcely be overrated seeing that upwards of 70,000,000 tons of coal alone pass over the various lines in the United Kingdom every year. The growth of the traffic is also being alluded to, and it is pointed out that a more equal distribution of the rates would greatly benefit the miners, and all connected with the production of coal, as well as the public generally.

THE TAY BRIDGE DISASTER.

THE Board of Trade inquiry into the Tay Bridge disaster was resumed at the Wreck Commissioner's Court, Westminster, on Thursday morning, before the Wreck Commissioner, Mr. H. C. Rothery, assisted by Colonel Yolland, R.E., and Mr. W. H. Barlow, C.E., as assessors.—Mr. Henry Law, C.E., continuing his evidence, said that the most important factor of the whole question was the extent to which the tie-bars would yield under the influence of strains, and that the Court had not yet obtained.—The Commissioner observed that as some of the results as to the testing of the strains upon the bolts made by Mr. Kirkcaldy were not forthcoming, and Mr. Law could not consequently complete his evidence in chief, there would be some difficulty in Mr. Law being examined piece-meal or cross-examined until he had given all his evidence. The Commissioner observed that the Court were informed at Dundee that there was an engineer named Grothe who, being then employed on a Spanish railroad, could not attend and give evidence. After some discussion between counsel, Mr. Albert Grothe, who was in court, was called. Examined by Mr. Trayner, he said he was now manager of the Tharsis mines in Spain. He was appointed as resident engineer at the Tay Bridge by Messrs. De Berg and Co., and his special duty was to superintend the building of the Tay Bridge, and he had also the supervision of the purchase of the materials and the manufacture of parts of the pier, either at Manchester or Cardiff; but under Messrs. Hopkins, Gilkes and Co., by whom he was afterwards employed, he was purely the manager of the bridge works, and had less control, so far as iron was concerned, than previously. The intention was originally to have all the piers built of brick, with the exception of some small piers on the north side. Fifteen on the south side were accordingly built of brick, under the contractorship of De Berg and Co. After Hopkins and Co. took the contract, the remainder of the piers were built of iron; but the change of material was decided upon during the latter part of De Berg's contract, in consultation with himself (witness). The change was decided upon because the bed of the river was not found to correspond with the contract plans. The contract plans were prepared by Sir Thomas Bouch. The inaccuracy in the drawings also led to the enlargement of the foundations, and to a lightening of the top part of the structure. In consequence of the discovery of the nature of the bottom, the piers originally intended for the larger spans were used as the foundation of the smaller ones, and instead of the larger span two new ones were intended to be put, but that intention was not carried out, because of further difficulties in the sinking of the smaller piers. There were to have been eight columns, but only six were erected.—Mr. Trayner: Why was that change made?—That I cannot answer. By whose instructions was the change made?—Sir Thomas Bouch's.—Was any reason assigned for the change?—No. The Commissioner: Was there room on the caisson for eight columns?—Yes. But on the pier as raised from the caisson was there room for eight columns?—No.—The witness continued that he could not explain why two of the eight columns were dropped out, but a reasonable explanation would be that to put the eight columns would have necessitated an extra amount of brick-which the caisson would not have borne. The length of the large spans was also altered from 213 feet to 245 feet because of the inaccuracy in the drawings. The dimensions had to be made greater and stronger. Sir Thomas Bouch, in conversation with witness, expressed his great disappointment at the deception of the borers; they have reported rock, where perhaps there was only boulder. At first witness constantly supervised the works of the bridge, but seeing that the work was going on well, he confined his visits to once a day. He did not test to ascertain the strength of the columns, but he occasionally tested the accuracy of the castings. All the columns he found or were reported to him as defective were broken up, as were also those which were filled up with cement or foreign substances. Strict injunctions were given that defective columns should not be used. By experimenting he was convinced that the burning on to the columns of "lugs" was not injurious to the strength of the structure. Personally he did not test any of the iron used in the structure. It all came ready for use, and to test it then would have weakened it. All the iron in the piers except the column wa malleable. The stones in the foundation were too smooth-faced and too large. He should have preferred small stones and many joints to large stones and few joints. Mr. Trayner: Why did the alteration in the design of the foundation lead to the extension of the span?—Because there must be a certain proportion between the money spent on superstructure and the money spent on the piers to produce the cheapest bridge, and it was found that by making the spans as they have been made, a cheaper bridge could be produced without sacrificing anything than if the spans had to be as they were before. A more costly pier was substituted for a cheaper one, and therefore making fewer piers and lengthening the spans. The substituted foundation was more costly than the one originally intended.—What had occasioned the catastrophe?—A strong wind on the evening of the accident.—Has that always been your opinion?—Yes. Witness continued that everything he had seen of the fallen and recovered portions of the bridge pointed to the whole thing having come down by a simple smash by the falling down of something from the top. The only remarkable thing was that the fall had not caused more of the bridge to come down. The bridge first gave way at pier No. 33, and the wind blew it over. He thought the stones under the bed plate lifted, and the whole of the column fell over from its base. The fact of the bridge going over showed that the base was not large enough. (To Mr. Bidder, Q.C.:) For want of any other conclusion he was driven to that which he had given, namely, that the wind blew the bridge over. The alteration in the number of piers and the length of the spans did not impair the efficiency of the bridge. Up to the time of the disaster his independent opinion as an engineer was that the width of the base was sufficient. The alteration of the plans was necessary when Sir Thomas Bouch found he had been deceived as to the bed of the river. All precautions were taken to prevent the introduction of inferior material and work. Even if it was his duty to do so, he did not know what test he could have imposed upon any of the columns to test whether they were fit for parts of the structure. (To Mr. Webster, Q.C.:) He had heard no suggestions as to the iron used being improper material.—Mr. Barlow: How did the cement get into the columns?—When the columns were completed the cement was poured in at the top; the cement being mixed on the platform and then let drop the whole of the ninety feet until the whole was filled. It would take about three days to fill each pillar. He did not find any escape at the joints. (To Mr. Webster, Q.C.:) With the exception of the cement, it was no part of his duty to test at the works. There was no defect in the workmanship which could have caused the downfall of the bridge. (To Mr. Balfour:) The diminution of the height of the bridge would have given it a large factor of safety. (Re-examined by Mr. Trayner;) All the broken stones he had seen could be accounted for by a smash by falling portions of the bridge.

On Friday morning, Mr. Albert Grothe, civil engineer, continued his evidence. In answer to the Wreck Commissioner, he said,—When the design of the bridge was contemplated, Sir Thomas Bouch consulted with him, and he (witness) approved in the main of the alterations. The intention of having brick instead of iron piers was abandoned because the foundations would not support piers of such weight; but, if the foundations had been sufficient, brick, instead of iron, piers would have made the bridge stronger. The alteration in the caissons at the base involved the employment of six, instead of eight columns. The outer columns, which had to bear the greater strain not only of the train, but of the weight of the superstructure and the pressure of the wind, had a total capacity of resistance considerably less than that of the two internal columns. Theoretically a span of 245 feet would require a heavier pier than a span of 215 feet; but in practice he thought not The lengthening of the spans and the alteration in the material and plan of the piers had nothing whatever to do with the contract price. As altered, the pier was made weaker than originally intended. On his own responsibility he gave instructions to increase the strength of the columns in the casting from 1 inch to 1½ inches in thickness in order to make up for the inequalities produced by the alterations in the original plans. Many columns were rejected because they were bad. He saw many of the columns broken up, but he did not see more inequalities in the castings than he should have expected to see. When he made his inspection of the bridge he found defects which, had he known of them at the time the bridge was being built, he should not have allowed. There was no doubt the specifications requiring the girders to bear a strain of twenty-one tons also applied to the tie bars and the other ironwork. As far as he knew, Sir Thomas Bouch did not employ any one to test the tie bars. The caissons would bear a pressure of two tons per square foot. He would not like to put a pressure of three tons to the square foot upon them. Could not account for the cracking of the columns. The sea water used for wetting the Portland cement with which the boxes of the columns were filled would cause a swelling of the cement in settling. The effect of frost upon the cement would be that the iron would contract, a tensile strain would be created, and a swelling would be produced. The original brick piers were a hundred times stronger than was necessary, but at first the iron piers were considered perfectly sufficient. He could not say whether any allowance had been made for the effect of the wind-pressure in the construction of the bridge. On the question of wind-pressure he desired to refer to a statement which he had made in a lecture to the effect that the bridge was strong enough to resist 90 lb of wind-pressure. The greatest wind-pressure that had then been known in this country was that in which the *Royal Charter* went down, when there was a pressure of 21 lb. to a square foot, and upon that calculation the bridge was built.

Mr. Law was here recalled to state the results of Mr. Kirkcaldy's experiments, so far as they had yet gone. With reference to the bolts, Mr. Law said that the first experiments were dated the 21st of April, and there was nothing in the results to indicate that the bolts were of inferior iron. The further experiments of the 22nd of April were in reference to the tie bars, and here the results varied, the strength generally being lower than in the case of the bolts. The first one broke at a pressure of 24·8 lb. per square inch, and the other two at a pressure of 26·103 lb. and 25·618 lb. respectively. The force of wind required to overthrow the structure with the train upon it was 36·58 lb. He made the estimate assuming that everything was perfect in the structure both as regards material and workmanship. Had everything been perfect, the structure must have gone over on the lower columns and no others. If all the struts had been equally strong and perfect, and each had done its duty, the structure must have gone down on the lower line, which was the line of least resistance. That was his opinion. It would require a wind pressure equal to at least 41 lb. to overthrow the train itself. The immediate cause of the failure of the structure was that the resistance which it offered to a rocking motion was not sufficient for the amount of lateral strain upon it on this occasion. It probably had by the passage of faster trains been loosened in parts, and even supposing the loosening had been tightened by the insertion of iron, he considered that the raging of a storm for some hours would have been quite sufficient to loosen those parts again. A strain had been put on the bridge which, when a train then came on it, the structure was unable to resist, it was overthrown, and the part which first fell was that where the train was. At the expansion joints it was evident that as soon as the bridge began to be overthrown the girders parted, and that they were drawn off the piers and fell partly through them. He did not think the structure was brought down by wind pressure alone. The mode in which it fell showed that there must have been some weak points in the structure. The bridge was not in a perfect condition to withstand a pressure of wind approaching to 36 lb. He considered the defects in the structure such as careful supervision would have detected. Expressing his own view of the way in which the bridge should have been constructed, he considered that every bolt should have fitted the holes, that every strut should have been accurate, that all the joints of the columns should have been perfect, and that the parts should have been accurately fitted together story by story beforehand and carefully marked, so that in putting them together again it would have been impossible for the workmen to make any mistakes or to find holes which did not coincide, requiring to be cut out by a rough tool in a way that had been described. The loosening of the colters should have indicated a progressive weakening of the structure. It was a thing which showed that a strain had been brought to bear upon ties or struts of some part of the structure to a sufficient extent to cause it to rattle. The course adopted by Mr. Noble indicated a want of mechanical knowledge and of appreciation of what was occurring. Had an engineer of skill observed those defects which were observed by Mr. Noble, he would have proceeded by the application of his skill to avert the catastrophe. Such a person would have incurred a heavy responsibility if he had not remedied the defects. The strength of the structure might have been very much increased by the mere introduction of direct ties, by carefully overhauling the structure and providing a remedy wherever any weak points were discovered, and in various ways. If the bridge to the eye of a man sufficiently skilled was in a state which threatened its stability, it would have led to the stoppage of the traffic until the defects were remedied. Speaking from the evidence, he thought the supervision of the castings at Wormit Foundry was not as careful as it should have been. In the case of such a structure the thickness of every column should have been seen to. The columns should not have been passed until each one had received the mark of the person who examined it as a guarantee that it had passed his inspection. Each story should have been erected, fitted, and marked beforehand, so that there could be no misplacement of parts. It should not have been possible to pass columns to be permanently used in the construction which had large blow holes filled up with foreign substances. That showed a great want of supervision or dishonesty on the part of the workmen, for it was quite possible that by dishonesty on the part of the workmen things might have been passed in a defective state without the knowledge of those who were responsible. He had no hesitation in saying that the channel iron did not afford any efficient security. The ties, too, were utterly insufficient for a rigid structure. There were instances where in the fall of the bridge holding-down bolts had been rooted out of their holes and the stones had been split. These results were consistent with his hypothesis as to the way in which the bridge came down.

Mr. Law's examination was continued on Monday. Replying to Mr. Bidder, Q.C., he said that he found the thickness of the columns of the piers only ⅜ inch in two cases. The least thickness he had found was 3-16th inch; that was on pier 33; that piece was in London. The one which was ½ inch in thickness was this externally, but when the holes were allowed for it was only 1-3 inch. The thinness extended from top to bottom. He examined the columns on the fallen piers to detect inequality. The thickness was only 3-16ths of an inch on column No. 4, pier 33. On column 6, pier 44, it ranged from ½ inch to ⅜ inch. He could not tell what area the 3-16th thickness extended over. On the opposite side that column was 1 9-16th of an inch. He did not think that the column would fracture. He had said in his report that the tie bars were 4½ inches by ½ inch, but their section was reduced by the bolt holes, which averaged 1¼ inch in diameter, but in some instances were somewhat more. Their sectional area to resist a tensile strain was 1·625 square inches, but the whole pull upon those ties were sustained by a gib ¾ inch in thickness, offering a surface for compression equal only to 0·375 square inches. Furthermore the strength of wrought iron to resist compression could not be taken at more than the 6-7ths of its tensile strength, or 40,320 tons to the square inch. Therefore, the greatest strain which those ties could be calculated to sustain would be 15,120 lb., or 6¾ tons. They had sustained 56,000 lb. in the experiments made, but the cotters had been crushed. The key, when exposed to the strain, yielded to an extent that would have overthrown the structure. They had not sustained the pressure, as they had yielded, and there was a crushing of the keys. A wind pressure of 36·8 lb to the square foot would be sufficient to overthrow the bridge. This he said on the assumption that everything was perfect, and apart from the consideration of errors in construction. The witness afterwards admitted that it would require a wind pressure of 70 lb. to the square foot to blow down the bridge. He should not have dreamt of putting up a structure that would not resist a pressure of 200 lb. per foot; a prudent engineer should never allow less than four times the greatest stress that could ever come upon a structure. A prudent engineer would take 50 lb to the square foot, giving a factor of four for safety. The second-class carriage was the lightest of the train. He had given 14,488 lb. as the weight of this carriage and 2·5 the half width between rails, and 5·90 feet the height of the centre of wind pressure above the rails. He had not attempted to estimate eddies. He assumed the wind to be horizontal. He had not estimated any upward force on the bottom of the carriage. If the last two carriages were overturned and brought up suddenly by collision with the girders, a weight of 35,000 lb. would have overthrown the bridge. He did not think the carriages went off the rails. If they had done so he thought they would have been smashed. Judging from the photographs he saw, there was nothing to indicate that the eastern part of the carriages came in contact with the bridge. He had not seen the remains of the train. Assuming 16 tons or 40 feet a second to smash into the leeward girder, it would have been a serious matter and might have led to the destruction of the girder. Whether the girder having been destroyed would have brought down the bridge was another matter. That the carriage should have come against the girder was inconsistent with its appearance as shown by the photographs. He believed all the couplings were broken, except between the guard's van and the second-class carriage. The body of the second-class carriage was destroyed, This suggested to him that the second-class carriage was of the old sort and weaker in construction than the others. He thought that the fact of the couplings of the second-class carriage not having been broken showed that there was not a sudden arrestment of that carriage; but on looking at the photograph he found that those couplings were broken. On the west side of the hinder part of the body of that carriage there was a trace of something having come in violent contact with it. The impact of the guard's van would have produced that. It was not possible to have arisen from a column falling on it. The engine, tender and first four carriages did not show so much injury. He did not think it at all possible that the framework of any of those carriages could have been carried against the western girder. He thought the guard's van and the second-class carriage were weaker than the others. By Mr. Webster, Q.C.—The slots for the gibs and cotters were roughly punched, and showed defective workmanship. The roughness of the sides of the slots, caused by the punching, had a decidedly injurious effect on the stability of the ties and the tightening of the cotters. The sides of the slots ought to have been quite smooth, it being impossible to get an accurate fit with a rough side. The roughness of the slots prevented the cotters from fitting close. There was a play in some instances of a quarter of an inch, and he did not see a single fitted slot throughout the whole bridge. He did not believe that under any circumstances cotters would work loose if in the first place they had been properly fitted. With reference to the looseness of four bolts in connection with one of the fractured columns and the box girder, he said this did not cause the catastrophe, but he had no doubt that it tended in that direction. He had no reason, however, to complain of the quality of the iron used beyond that it was not a good mixture. He maintained that the bolts and the holes should be drilled and accurately fitted.

On the resumption of the inquiry on Tuesday, the first witness called was Mr. John Cochrane, member of the Institute of Civil Engineers, who said he had had a very large experience in the erection of bridges on columns. He had put up the Westminster Bridge, the Charing Cross bridge, the Cannon Street Bridge, and the large bridge over the Mersey. He visited the ruins of the Tay Bridge on the 1st of April, and stayed there for a few days. He was there again on the 11th and 12th of April with Mr. James Brunlees, civil engineer. They went at the request of the North British Railway Company. He was to report on the alleged inferiority of the iron, the imperfect workmanship, and the quality of the wrought iron used for bracing up the piers, and also as to the causes of the disaster. He formed the opinion that the wrought iron was very good. The cast iron he considered to be of a very fair quality. He applied no tests to the iron. He considered that the mode of casting the 15-inch columns was not good. He noticed an accumulation of slag at a lug and a column in one or two instances. He saw one or two cold shuts on the columns. That would arise from the iron nor having been put into the mould in a sufficiently hot state. To say that Cleveland iron is sluggish is to say that it was not hot enough. He particularly noticed that the holes in the lugs to which diagonal bracings were secured by means of bolts were not parallel. When the bolt was put through and a strain put on the tie bar the effect would be to bend the bolt. He found several bolts so bent. He should have thought that the inside of the column was not more than ¼ inch larger than the outside. The result of the faulty casting was that frequently the top part of the box would not go into its place, and that the thickness on both sides of the column would frequently be reduced. He saw at the bridge two or three columns which showed slippings of their protuberances. He did not like the recess in the flanges; he would have liked them faced over the whole surface. He did not think it was a good thing to cast the lugs on the columns. He did not think the attachment was good. At the junction between the lug and the main body of the column there was always liability of porosity. He would have made the bolts larger in diameter. He would have provided for the contingency of a hole not having been properly cast. The flanges were cast with an angular channel. This was a defect. The holes in the flanges were drilled. The holes in the flanges of the 18-inch columns were all cast. The holes in the flanges of the 15-inch columns were 1¼ inch to receive 1⅛-inch bolts, which were too large, as they gave too much play. The bolts had more play in the flanges of the 18-inch columns. He did not approve of this. He had seen some of the holes in the channel iron and had seen that some of them had been elongated for the bolts to be fixed. He should say that the elongation was in the same direction in both holes. He did not observe that packing pieces had been put in by the side of the cotters. He understood that they had been removed before he got there. Mr. Law took away several with him. He thought that the disaster arose from the extraordinary pressure of the wind. By its action and by that of previous winds a great many bolts that connected the diagonal ties got bent, which would have allowed of considerable lateral motion and caused the lugs to give way. The bending of those bolts would be indicated by the shaking of the tie bars. He thought that on the night of the storm the bolts were bent up to the top of the structure. It would have been better that the ties should have acted both as struts and ties, although it would have been difficult, though not impossible, to make them so act. He thought the yielding of the bolts tended to the disaster. It was exceedingly doubtful whether by any examination the yielding of those bolts could have been detected. If he had noticed the ties giving way he should have communicated with the chief engineer with a view to adopt some method to prevent its recurrence. The girders were continuous. He thought that their continuity assisted the disaster. Supposing a locomotive and tender had arrived at a distance of forty feet to fifty feet from a pier, say No. 4, the girders being continuous, there would have been a deflection of the fourth span, and that deflection would have lifted the overhanging portion of the fifth girder. He thought that the upward force of the wind should be taken into consideration. If there had been an upward pressure on the fifth girder it might have been lifted out of its rollers. The effect of the wind would have a tendency to slide the girders off the rollers. Those girders were on expansion joints. It was a difficult thing to attach girders to a pier, but they might have so devised as to prevent it from moving sideways. He thought that there should have been something else done to prevent that sliding motion. The tops of the piers should have been connected so as to make a pier of six columns. He would have carried the L girder right round. If the girders had been separate from pier to pier they would have admitted of more satisfactory attachment. On some of the piers he noticed that some of the columns had been forced westwards. He thought it probable that on No. 5 pier the eastern set of columns were under the eastern girder and the western columns were over the western girder. The eastern columns gave way first, and the western columns fell over the top. The eastern part fell first, and the eastern and western separated from one another. If the columns had been strongly fitted and strongly held down with holding-down bolts, he believed the bridge would now be standing. The guard's van was exceptionally strong. If the second-class carriage had left the lines by the couplings breaking, the guard's van would have smashed it to atoms. The appearance of the guard's van did not show that it had run into the carriage. He thought nothing of the condition of the bodies of the carriages. They might have been smashed in raising or blown up with the dynamite that had been used. The first four four carriages had been found standing. He did not know that the last two were on their sides. Supposing the second-class carriage to have tilted over, it would have brought a powerful action to bear on the couplings of the carriage before it. The only portion that could have come in contact with the girder was its roof. If it struck the girder it would have been cut through and not knocked round, as it was so slight as compared to what it struck against. The upward force of the wind would not much affect the carriage. He saw nothing to make him think that the disaster was caused by a collision. It was a very hard thing to guard against a conical form in a lug, as moulders would alter the core. He would have altered the size of the belt or rimed out the hole to make it parallel. Assuming that the bridge had been gone through and all the ties which had got loose by the action of the wind had been tightened, it would have been restored in a very great measure to its original structure; but in so doing the lug must have been injured by bringing an undue strain upon it. He had not gone into calculations of strains, but he thought the bolts would bend before the cotters were compressed. He did not think that in a structure of this kind it ought to be necessary to tighten up from time to time. A weight of 224 tons and 1½ tons to the running foot would be a big test for the bridge. If four engines coupled had been sent over the bridge at the rate of 40 miles an hour, it would have been ascertained if any cotters were loose. The defects in the casting did not help to bring down the bridge.

Albert Grothe, recalled, said, in reply to Mr. Webster, Q.C., that before he left in 1877 ballast trains had been running over the bridge for two months. He thought the cotters would require to be looked at from time to time. There might have been slackening of the ties. If he had stayed at the bridge he should have paid attention to them.

The first witness called on Wednesday was Mr. James Brunlees, who, in reply to Mr. Trayner, said that he was a civil engineer in London. He visited Dundee, in company with Mr. Cochrane, for the purpose of examining the quality of the material used, the workmanship, and also to form an opinion as to the probable cause of the disaster. He had had a large experience in the building of bridges for the last 27 years—bridges with cast-iron piers and wrought iron superstructure. He had built bridges which would extend a distance of about four miles. He concurred with Mr. Cochrane's evidence, both as to the result of observation and in opinion. In reply to Mr. Bidder, the witness said that unless an excessive weight were put on the bridge, the design of the structure was sufficiently strong if it were properly executed. He thought that the bridge was designed to meet 40 pounds pressure. He had allowed for a wind pressure of 30 pounds. A vertical crack in any of the columns would not, in his opinion, be of any moment. In reply to Mr. Webster, the witness said that he considered the quality of the iron used in the construction of the bridge to be very good. In reply to Mr. Balfour, he said it would be more easy, as well as more safe, if the bridge were made less by say, 20 or 30 feet. On the witness being asked by Mr. Trayner whether he would prefer cast-iron columns to brick piers, Mr. Bidder objected to the question. The Wreck Commissioner said the question must be allowed, as they were there not only to inquire into the cause of the disaster, but also to inquire into all the circumstances affecting the reconstruction of the structure. The witness in reply to the question, said that he would just as soon use cast iron as brick.

At this point the court adjourned for a short time in consequence of Colonel Yolland being summoned to appear before the Exchequer Division to give evidence in the case of Cummings v. the Great Northern Railway Company.

On the court resuming, Mr. Webster said he wished to recall Mr. M'Beath for the purpose of seeing whether there were three, eight, or four bolts in the L girders. On the question being put to Mr. M'Beath, he said that there were eight bolts, and he never saw any vacant hole where a bolt should have gone in. In reply to Mr. Bidder, he said that when he was inspector of the bridge he went through the columns with a view to seeing that the tie-bars were properly tightened. He was employed in seeing that the gibs and cotters were properly tightened. He examined every strut and tie-bar, and under his supervision they were all made tight. Mr. Trayner: He could not exactly say how many tie-bars he tightened, there were so many of them. They were tightened by driving up the cotters. Some of these cotters would go a quarter of an inch. The cotters had not altered, but during the inspection they were driven further home. On some piers there were none which required driving, and on others there were from eight to ten. When driven home the cotters all held. He did not put any packing pieces in to tighten the cotters. When the ballast trains were passing over the bridge he did not observe any chattering from any of the bars being loose.

The next witness called by the Board of Trade was Mr. Frederick William Reeves, who said that he had come from Lisbon to attend this inquiry at the request of the North British Railway Company. He was working on the Tay Bridge both under the original contractors, Messrs. De Bergue and Co. and Messrs. Hopkins, Gilkes and Co., as Mr. Grothe's assistant. He left the bridge about the 28th of December, 1877. He had nothing to do with the examining of the iron or with the Wormit Foundry. He was chiefly connected with the erection of the bridge according to the plans, and so far as he knew every part of the bridge was put in its place. According to both the original and altered plans every part of the work was well done. In reply to Mr. Webster, he said he never saw any unevenness in the bolts on the base. He did not think that when the base plates were screwed on that the bolts would come out of the cement or break away. To the knowledge of the witness no cotters were loose when he left the works.

General Hutchinson, the Government Inspector, was called. He said he inspected the bridge in February, 1878, and presented his report in the following March. He first made the examination of the bridge above and below water line, and then tested it for defection and oscillation. Each girder was tested seriatim. The high girders were tested by running six engines over at the rate of 40 miles an hour. He observed no signs of weakness. There should have been a constant supervision to see that the bolts, &c., kept tight. He would have examined the bridge again but for serious illness.

Railway Accidents.—From the returns of accidents and casualties reported to the Board of Trade by the several railway companies in the United Kingdom during the year ending the 31st of December, 1879, it appears that there were reported 37 collisions between passenger trains, by which 151 passengers and seven servants were injured; 95 collisions between passenger trains and goods or mineral trains, engines, &c., by which two passengers and one servant were killed and 258 passengers and 50 servants were injured. There were 71 cases of passenger trains leaving the line, by which one servant was killed, and 49 passengers and five servants were injured. There were in the year 150 cases of trains running over cattle or other obstructions, 58 cases of trains running through gates at level crossings, 49 cases of floodings of portions of permanent way, two fires in trains, and two in stations. Of passengers there were during the year 75 killed and 602 injured; of servants of the companies, eight killed and 118 injured; and of "other persons" one was killed and no "other person" was injured. The total amounted to 84 killed and 720 injured.

Bell's Tramcar Brake and Restarter.—A trial of an interesting character took place yesterday afternoon on the tramway line in the Blackfriars Road, London, with Bell's tramcar brake and restarting apparatus. This appliance was fixed to a truck representing the underframing of a tramcar, and which was drawn by horses. It consists of an arrangement of spiral springs in connection with a chain attached to a drum working on the axle of the car wheels and capable of being thrown into and out of gear with a system of clutches and spur gearing. To put on the break the driver releases a lever which causes the chain to be wound on the drum, thus compressing the springs and retarding the action of the wheels. In restarting the driver releases the clutch from the drum, and the springs coming into play unwind the chain from off the drum, and in so doing the axle, and with it the wheels, are revolved in a forward direction, thus giving an impetus to the tramcar and assisting the horses. The trial yesterday, which proved very successful, was made under the patronage of the Royal Society for the Prevention of Cruelty to Animals. In its results it showed that the invention is calculated to assist the horses considerably in starting, as when the apparatus was tried with the animals removed the truck was propelled some distance forward by the release of the springs.

NAVAL ARCHITECTURE.

LAUNCHES.

English.

Akaba.—On the 26th April Messrs. M. Pearse and Co. launched from their iron shipbuilding yard at Stockton, an iron screw-steamer of the following dimensions:—Length between perpendiculars, 300 feet; extreme breadth, 36 feet; depth of hold to top of floors, 25 feet 6 inches. This vessel is about 2300 tons gross register, and will carry about 3300 tons deadweight at about 22 feet draught of water. She is built of the highest class granted at Lloyd's. She has a full poop aft in which is fitted a handsome saloon with passengers' and officers' accommodation, and other offices. This vessel is built off the three-decked rule, with two decks laid, both being of iron. She will be rigged as a three-masted schooner, and will carry double topsails on her foremast. She will be provided with engines on the direct-acting, surface-condensing principle, of 280 horse-power nominal, from the well-known establishment of Messrs. Blair and Co., of Stockton, four steam winches, patent steam steering gear, has double bottom for water-ballast, and all the most recent and improved appliances for expeditiously loading and discharging cargoes, and for ventilating and other sanitary purposes. This is the second vessel Messrs. Pease and Co. have built for her owners, for whom also they expect to launch a sister ship in the course of a month or six weeks. The name given to the vessel was *Akaba*.

Freda.—The first racing yacht ever built "above bridge" was launched on April 26th from within a stone-throw of Old Battersea Bridge. She has been built from a design of Mr. J. Beavor-Webb, and under the immediate supervision of that gentleman. The new yacht is named the *Freda*, and is owned by Mr. T. G. Freke, of Grosvenor Gardens. She is a notable addition to the 20-ton racing class, and the whole of her ballast (17½ tons) is carried on the keel. The vessel, in regard to work and shape, could not be surpassed, and the novelty of a yacht launch in this neighbourhood did not pass unnoticed, as the old Bridge, Cheyne Walk, &c., were crowded with spectators, and on the river there was quite a flotilla of boats. The new yacht will make her first racing essay in the Royal Thames Yacht Club races next month.

Sierra Estrella.—On the 26th inst., an iron sailing ship was launched from the building yard of Richardson Duck and Co., South Stockton-on-Tees, of the following dimensions, viz.:—Length over all, 251 feet; ditto B. P., 232 feet 3 inches; breadth (extreme), 37 feet 9 inches; depth in hold, 22 feet 7 inches; tonnage, O.M. 1588 tons; gross N.M, 2499 tons. She is classed 100 A at Lloyd's, and 20 years in the Liverpool Registry, but is considerably stronger than required by their rules. She has a full poop for the accommodation of the captain and officers, and a topgallant forecastle for the crew. She will be rigged as a ship, and is fitted with one of Harfield's patent windlasses. The vessel has been built to the order of Messrs. Thompson, Anderson and Co., Liverpool, and is intended for the India and China trade. As she was leaving the ways she christened the *Sierra Estrella*.

St. Gothard.—On April 24th a steamer was launched from the building yard of Messrs. Readhead and Co., South Shields. The new vessel, which was named the *St. Gothard*, is 255 feet long, 34 feet beam, 23 feet depth of hold, built on the three-deck principle, to be classed 100 A 1 at Lloyd's. She has iron decks, and is fitted with water ballast tanks throughout, and will have steam winches, windlass, and all the latest improvements. Her engines, which will be put in by Messrs. Readhead and Co., are to be of 150 horse-power. The accommodation for the crew is to be on deck. She has been built to the order of Messrs. Hall, Cay and Co., South Shields, and is destined for the American and general trade.

Scotch.

Aline.—There was launched on the 24th of April from the shipyard of Messrs. Ramage and Ferguson, Leith, a beautifully modelled steam yacht of 360 tons, built to the order of Mr. W. B. Walker, of London and Brighton. From her fine lines and powerful engines a high rate of speed is expected. The vessel was named *Aline*.

Chancellor.—On April 21st a saloon paddle-steamer, the most recent addition to the fleet of the Lochlomond and Lochlong Steamboat Company, and intended for their Helensborough and Arrochar traffic, was launched from the shipbuilding yard of Mr. Robert Chambers, jun., Dumbarton. The vessel, which is built of steel, is of the following dimensions:—Length, 208 feet; breadth, 21 feet; depth, 7 feet 7 inches. As the vessel moved off the stocks she was christened the *Chancellor*. It is expected that the new *Chancellor* will be ready for her station at the beginning of the season.

Cyclops.—On the 22nd April Messrs. Scott and Co., shipbuilders, launched from their shipbuilding yard at Cartsdyke, a screw-steamer of the following dimensions:—Length, 320 feet; breadth, 43 feet; and of about 2301 tons burden, with engines of 300 horse-power. She has been built to the order of Messrs. Alfred Holt and Co., Liverpool, for their China trade, and is sister steamer to the *Laertes*, which was recently built and fitted out for sea by the Messrs. Scott. On leaving the ways the new steamer was named the *Cyclops* and was afterwards towed down to the Victoria Harbour and put under the large steam crane to have her machinery put on board.

Hispania.—There was launched from the building yard of Messrs. D. and W. Henderson and Co., Meadowside, on the 24th April, a very handsome screw-steamer of the following dimensions:—Length, 365 feet; breadth, 38·5 feet; depth, 28·7 feet; and of 3300 tons register. This fine vessel, which was named *Hispania*, will form a valuable addition to the well-known fleet of the Anchor Line, and is intended for their Indian service. Immediately after her launch she was towed up to the new crane at Finnieston, where she will at once commence receiving her machinery, which has been made at Messrs. D. and W. Henderson and Co.'s engineering works at Finnieston Quay.

Lake Manitoba.—On the 26th April, there was launched from the yard of Messrs. James and George Thomson, at Clyde Bank, the *Manitoba*, a splendid screw-steamer, of

3500 tons and 400 horse-power nominal, for the Canada Shipping Company. The *Manitoba* will form a valuable addition to the fine fleet of the Canada Shipping Company, and will be placed on the station betwixt Liverpool and the Canadian ports.

Ranee.—On the 24th April, Messrs. Dobson and Charles launched from their shipbuilding yard at Grangemouth a handsome screw-steamer, built to the order of Mr. Joseph Linn, Bristol, and of the following dimensions :—Tonnage, 350; length, 135 feet; breadth, 22 feet; depth, 11·3 feet. She was named *Ranee*. Her engines, which will be 45 horse-power, will be constructed by Messrs. Dunsmore and Jackson, Glasgow.

Rohilla.—On the 27th of April Messrs. Caird and Co., Greenock, launched a fine screw-steamer of about 3600 tons for the Peninsular and Oriental Company's mail service. Her dimensions are as follows :—Length, 284 feet; breadth of beam, 40 feet; depth moulded, 28 feet 2 inches. She is classed 100 A1 at Lloyd's as a three-decked steamer. As she left the ways the vessel was christened *Rohilla*. The *Rohilla* will be supplied with engines of great power by Messrs. Caird on the compound surface-condensing principle, and combining all the most recent improvements. The steamer has been fitted up luxuriously for the comfort of her passengers, of which she can carry a considerable number.

Tridente.—On the 26th April Messrs. Wm. Denny Brothers launched from their shipbuilding yard at Dumbarton, a steel saloon paddle-steamer of the following dimensions, viz., 185 by 27 by 11; gross tonnage, about 700 tons. She has been built for the Lloyd's Argentino de Navegaceon a Vapor Company, and is intended for passenger service in South America. This company has been formed in London with the view of developing the traffic of the River Plate. The vessel on leaving the ways was named the *Tridente*. The engines, which will be supplied by Messrs. Denny and Co., are of the compound surface condensing type, and of 800 horse-power. The *Tridente* will be fitted up in the highest style, and superior to any steamer on the River Plate. The company have at present in the course of construction by the same builders another saloon steamer for the River Plate traffic, and it is their intention further to develop this traffic by placing some steamers in connection with the Buenos Ayres and Campana Railway, and also in connection with the Tucuman and Cordoba Railway. The steamers are being constructed under the superintendence of Captain Vacassovich.

Ulloa.—Messrs. Napier, Shanks and Bell on the 27th of April launched from their yard at Yoker the *Ulloa*, an awning-decked screw-steamer of about 950 tons—a duplicate of the *Soto*, launched by the same builders about a month ago. The *Ulloa's* machinery will be put on board by Messrs. Dunsmuir and Jackson, and thereafter she will load under charge of Messrs. Wilson Bros., Glasgow, for Barcelona. The berth vacated by the *Ulloa* will be immediately occupied by a new steel passenger vessel for colonial service.

Vigilant.—On April 21st Messrs. Murdoch and Murray launched, at Port Glasgow, the third of four screw-steamers being constructed for the Great Northern Fish Carrying Company. The steamer is named the *Vigilant*, and is of the following dimensions :—Length, 130 feet; breadth of beam 21 feet; depth of hold, 11 feet. The engines are supplied by Messrs. Muir and Houston, Glasgow. The *Vigilant* was at once towed up to Glasgow.

Trial Trips.

Allan Macdonell.—The s.s. *Allan Macdonell*, 200 tons burden, built by the Campbeltown Shipbuilding Company for the Newry Salt Works Company, had her trial trip on the 26th of April. She is engined by Messrs. Ross and Duncan, Glasgow, with compound surface condensing engines, cylinders 13 and 23½ inches diameter by 18 inches stroke, 65 lb. double-furnace return tubular boiler, working pressure. The trial was considered extremely satisfactory, 9·72 knots per hour being attained under easy steam of 60 lb. per square inch, with an indicated horse-power of 125, and a steady vacuum of 28½ inches in condenser. Mr. Keenan, of Newry, acted as inspector for the owners, and expressed himself highly pleased with the result.

Trojan.—On the 22nd April the Union Steamship Company's Royal Mail steamer *Trojan*, of 3600 tons burthen and 3400 horse-power, which has just been completed by Messrs. J. and G. Thomson, of Glasgow, was tried at the measured mile on the Clyde, and attained an average speed of 14¾ knots per hour. The *Trojan* will leave Southampton on her first voyage with the Cape of Good Hope mails of 20th May.

Vincenzo Florio (s).—This new mail steamer, built and engined by Messrs. Alexander Stephen and Sons, Linthouse, for Messrs. J. and V. Florio and Co., of Palermo, proceeded down the Firth of Clyde on the 22nd of April for a trial of speed over the measured mile, afterwards going out as far as the Isle of Man for a more extended trial. The *Vincenzo Florio* is a screw-steamer of the highest class at Lloyd's, barque rigged. Her dimensions are 340 by 38 by 30·4½ moulded, giving about 3000 tons gross register. She is fitted with engines of 370 horse-power nominal, having cylinders 48 inch and 90 inch diameter by 4 feet stroke, the steam being supplied by two double-ended boilers with a working pressure of 75 lb. The vessel is built with a double bottom on the cellular principle for water ballast. Accommodation is provided under the poop aft for forty-two first-class passengers. Under the upper deck forward there is accommodation for 140 second-class passengers. She is fitted with all the most modern improvements for the working of the ship, and the rapid loading and discharging of cargo, having steam windlass, steam steering gear, steam cranes, steam winches, &c. At the measured mile the *Vincenzo Florio* attained a mean speed of 13·6 knots; on the extended trial of over 200 miles continuous steaming at sea, the average was 12·9 knots. These results, being very considerably in excess of those promised by the builders, gave great satisfaction to the representatives of the owners. The *Vincenzo Florio* is to be commanded by Captain Pirandello.

THE Hamburg-American Steamship Company have just contracted with Messrs. Dobie and Co., shipbuilders, Govan, Glasgow, for the construction of two steamers, each of 3000 tons for their Hamburg and New York service.

International Competitive Exhibition.—The Shipwrights' Company have commenced the elaboration of a scheme for holding an International Competitive Exhibition of models of ships early in 1882, which will be considered more comprehensive than the last useful and successful exhibition organised and held at Fishmongers' Hall in 1877.

A New Ducal Liner.—Messrs. Carlyle Bros., managing owners of the Ducal Line of steamships trading between London and Calcutta, have purchased the newly-launched 3000-ton steamer *Rosecastle*, from the Barrow Shipbuilding Company. She has been built on same lines as three other Ducal Liners which were built at Barrow. The steamer is to be named the *Duke of Buckingham*.

Shipbuilding in the Clyde.—Within the past few days six new steamers have been contracted for by Clyde shipbuilders—three for the Pacific Steam Navigation Company, two for the Hamburg-American Steamship Company, and a sixth for a firm engaged in the American trade. The fall in the price of iron is said to be the cause of this spurt in shipbuilding. The Clyde yards show a marked improvement in trade as compared with the corresponding period of last year.

H.M.S. *Hotspur*.—Messrs. Laird Brothers, of Birkenhead, recently undocked the *Hotspur*, which has been in their hands for some time past for alterations and repairs. The principal alterations made are the substitution for the old fixed turret of a revolving turret of the latest construction, protected with compound steel armour plates equal in resisting power to about twelve inches of iron, and carrying two guns of equal power to the one 600-pounder originally carried. Appliances for working the Whitehead torpedo have been provided, and new boilers have been put in.

Barrow and the Atlantic Trade.—The development of the shipping trade of Barrow has been very marked during the past few years, and a large expenditure of money has been incurred in the provision of dock accommodation and other facilities for the largest class of steamships and ordinary sailing vessels. Already the large area of new accommodation has to a great extent been utilised. A few months ago a new line of steamers commenced running direct from New York to Barrow, and the managers of the Anchor Line have been so encouraged with results which have already presented themselves that they have announced their intention to commence running steamers at regular intervals from Barrow to New York. The pioneer steamer will leave Barrow in three weeks, and there are indications that there will be a large tonnage of cargoes from Barrow and the district for direct shipment.

The "Atalanta."—Among the passengers of the *Tamar*, which reached Portsmouth on Monday from Barbadoes, was an able seamen named Varling, who was invalided from the *Atalanta* on the 3rd of January, and received on board the *Tamar* on the 2nd of April at Barbadoes. Varling reports the missing training ship as being exceedingly crank, as being overweighted with ship rig instead of being fitted out as a barque, and as having aroused the distrust of Captain Stirling. She left England on the 7th November, and arrived at Teneriffe, which was the first port called at, in twenty-one days. She remained three days at Teneriffe, after leaving which place they were obliged to heave-to for seven days and as many nights in a gale of wind, under close reefed main-topsail, storm staysail and storm trysail, the topgallant mast being housed and the upper yards sent down upon the deck. She rolled 32°, and Captain Stirling is reported as having been heard to remark that had she rolled one degree more she must have gone over and foundered. During this trying situation the peculiar weaknesses of the ship's company were brought prominently into notice, as, with the exception of two, the officers were almost as much out of training as the crew. Captain Stirling scarcely ever left the deck, and the work of shortening sale and sending down the spars was left to the able seamen on board, who, including marines (mostly servants), petty officers and cooks, only numbered about fifty in a crew of 250. The number was further diminished at this time by the death of John M'Clure, an able seaman, who fell into the sea from the topgallant-yard, and was drowned, despite every possible effort made to save him. Varling states that the young sailors were either too timid to go aloft or were incapacitated by sea-sickness. He adds that they hid themselves away, and could not be found when wanted by the boatswain's mate. It took the ship thirty-one days to go to Barbadoes from Teneriffe, the former part being reached on the 1st of January, or about nine days after time. The result was that provisions ran short during the voyage, fifteen pounds of biscuit being served out every two days for a mess of ten men. The *Atalanta* left Barbadoes on Friday, the 9th of January, for Antigua, where they caught the yellow fever. Two men, whose names Varling cannot remember, had already died from the disease. When on their way out from Antigua they met the *Tourmaline*, to whom they signified their condition, and, after transferring their sick, they proceeded to Halifax. There the training-ship received sailing orders for England. The ship called in at Bermuda on the 30th of January for water and provisions, and finally left for home on the 31st, since which time nothing has been heard of her.

ARMS, ARMOUR AND EXPLOSIVES.

The Protection of London.—Another of the chain of forts for the protection of Chatham Dockyard and Garrison, and of the approaches to London, will shortly be commenced on the road to Maidstone about midway between Chatham and Maidstone. The fort which is being built at Borstal by convicts will be a most massive structure, and is approaching completition. Several other forts will be erected before the chain is complete, which will make the road to London thoroughly protected.

Experiments with the Nordenfelt Gun.—A course of experiments extending over three days has just been concluded with the Nordenfelt machine gun, on the platform near the *Excellent* gunnery ship, at Portsmouth. In this type of gun, which has hitherto been supplied to the Navy, a defect in the half-cocking arrangement allowed the hammer to slip and explode the cartridge prematurely, while a similar defect in the carrier and guides permitted a cartridge which happened to remain in the barrel after missing fire to be exploded by the point of a subsequent cartridge; a serious accident from these causes resulted on board the *Comus* and the *Northampton*. Improvements have since been introduced into the mechanism of the weapon by Mr. Thusten Nordenfelt with the object of making accidents from these sources impossible, at the same time that they simplify the firing arrangements. The purpose of the experiments at the *Excellent* was to put the alterations to a practical test under every conceivable condition, abnormal as well as normal. The gun passed successfully through the ordeal, although twenty cases of ammunition were fired during the trials. It is now intended to subject the improved Nordenfelt to a competitive trial with the Hotchkiss revolving cannon at a moving target.

Navy Gun Trials.—A new series of navy gun trials is in preparation at the proof butts in the Government marshes adjoining the Royal Arsenal, Woolwich, the subject of the experiment being the method for mounting guns of the 100-ton type in land fortresses. Four of these guns, recently purchased from Sir William Armstrong are to be employed for the defence of the Mediterranean stations, two at Malta and two at Gibraltar, and before these are fixed in position the authorities have deemed it advisable to erect a model of the emplacements in which it is proposed to mount them, in order that their suitability may be put to the test of practice. The model emplacement is near completion, the platform and carriages are in position, and in a few days the gun will be ready for the trial. The construction of the emplacement has been a heavy and somewhat costly work, owing to the great quantity of material employed in making a foundation. The loading apparatus will be worked by hydraulic power, a piston rising from a tube 60 feet long, at an angle of about 20 degrees, to meet which the gun will have to be traversed to the right at each round and the muzzle slightly depressed. The end of the rammer when out of use is protected in an iron turret, one side of which is left open to show the working. A breastwork of concrete in imitation of masonry is constructed in front of the gun, which will fire just above the level of the glacis into one of the bays or the proof butts.

Experiments with Explosives.—On Wednesday last, Professor F. A. Abel, C.B., F.R.S., chemist to the War Department, conducted a series of interesting and remarkable experiments on the proof grounds in the Government marshes adjoining the Royal Arsenal, Woolwich, in the presence of many spectators, including a number of officers and cadets of the Royal Navy. Professor Abel began by explaining that the violence of action of an explosive substance is regulated by the resistance opposed to the escape of the gases at the first ignition; and, furthermore, that the partial confinement of the disengaged gases by the mass of the explosive alone is sufficient to develop violent explosion. These examples he proceeded to illustrate by the first series of experiments, showing that gunpowder, and even so powerful an agent as mercurial fulminate, when ignited on the surface, produced a mild report in comparison with the result of similar charges ignited at the base of the heap. The next experiments were devoted to an exposition of the theory of detonation, the development of which, the Professor said, was dependent upon the nature, quantity, and confinement of the detonator in relation to the nature and mechanical condition of the substance to be detonated. Thus 25 grains of mercurial fulminate exploded unconfined upon a mass of dynamite left the latter unimpaired, whereas only one grain of fulminate strongly confined produced detonation and the dynamite was thereby exploded. Similar experiments were tried with corresponding results with gun cotton, loose and compressed, and other compounds, and then Professor Abel, having laid down the axiom that rigidity of the mass is essential to detonation, proved further that the facility and completeness with which detonation is transmitted from particle to particle of a mass of explosive material is regulated by the rigidity in the resistance to mechanical motion which the particles offer. The most perfect explosive agent known to modern science was nitro-glycerine, employed through the medium of some suitable absorbent, one of the best of which was collodion gun cotton, as used by photographers. A new compound of nitro-glycerine and an absorbent had recently been produced under the name of blasting gelatine, and this was pronounced to be the most violent explosive known to science. This gelatine, however, dispersed with little effect when fired in its ordinary state; but when solidified by freezing, which was easily accomplished, it destroyed the iron plate upon which it stood. The difference between explosion and detonation was next lucidly demonstrated. An open case containing 5 lb. of powder was placed upon an iron plate and exploded, but the plate was scarcely damaged; a similar quantity of gun-cotton suspended 4 feet above the plate, however, completely crushed it, consequent upon the greater violence of the detonation and the suddenness of its development and transmission. The practical application of this rapid violence was displayed by the destruction of a bronze cannon by filling it with water and detonating therein a mere morsel of gun-cotton. Various peculiar qualities of gun-cotton were illustrated by successive experiments, and its power of transmitting detonation from one mass to another, as well as its rending capacity as distinguished from mere displacement, were evidenced in a startling manner by the destruction of a strongly-constructed stockade of heavy balks of timber, the tops of which were cut off level with the ground and thrown to a considerable distance. Other experiments followed, in which the efficiency and convenience of wet gun-cotton were exemplified; and, in conclusion, a charge was detonated under water, throwing up a pyramid of spray to a great height. Mr. Brown, assistant to Professor Abel, arranged the charges and fired them by electricity, and instantaneous photographs of the most remarkable displays were taken by the photographers from the Chemical Department of the Royal Arsenal.

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TO READERS AND CORRESPONDENTS.

SPECIAL NOTICE.

THE FOREIGN IRON TRADE OF 1879.

ON Friday next, being the last day of the Spring Meeting of the Iron and Steel Institute for 1880, a special number of IRON will be published, which will contain a full account of the Meeting of the Institute, with the papers read up to the 6th prox., and reports of the discussions upon them. With this number a special supplement will be published, which will contain, in addition to the usual trade reports, special reports from the Continent on the IRON TRADE OF 1879, prepared by well-known authorities on the subject, resident in the countries upon which they will respectively report, viz. :—

From BELGIUM—by M. Max Góebel, of Liége.
,, SWEDEN—by Professor Richard Akerman, of Stockholm.
,, AUSTRIA—by Freiherr v. Lindheim, of Vienna.
,, FRANCE—by M. Francis Laur, of Saint Etienne.
,, SPAIN—by Señor D. José Alcover, of Madrid.
,, GERMANY—

It is felt that the publication of these reports will meet a want which has been experienced at the last few meetings of the Institute, and of the Iron Trade Association, and, conjointly with the report of the Institute Meeting, will afford the most complete view of the actual position of the iron trade.

CHAMBERS' SAND DISTRIBUTOR.—In order to meet the requirement which has been long felt of a machine for sanding the surfaces of asphalted and wood-paved roads, as well as those laid with other materials, when in a slippery condition, Messrs. Richard Garrett and Sons, of the Leiston Works, Suffolk, are now introducing Chambers' distributor, by means of which sand or ballast can be efficiently and economically spread. In this machine the ballast is placed in a hopper holding a sufficient quantity to deliver over a length of a mile, and over which the driver sits. In the hopper is a stirrer having a reciprocating motion, and being driven by bevel gearing from a revolving cylinder placed beneath the hopper. This cylinder is driven from the travelling wheel and is formed with projections which are placed irregularly on its surface, the object of the cylinder being to distribute the sand evenly into a screen which is placed below it, and through which the material falls vertically upon the ground in an even stream. A number of flat spring scrapers fixed on a horizontal bar press against the cylinder and serve to keep it clean. The quantity of sand distributed is regulated by the driver by means of a slide, and he can also adjust the angle of the hopper to the inclination of the road so as to keep the delivery vertical when ascending or descending hills. The apparatus is mounted on a pair of wheels and is drawn by a horse. The first public trial of this machine took place yesterday afternoon on the embankment near the Chelsea suspension bridge, and was attended by a large number of district surveyors, including Mr. George Livingstone, the surveyor to the parish of St. George, Hanover Square, to whose order the machine tried was made. It is subject to his approval upon the results of the trial, which were so satisfactory that we do not for a moment suppose the makers will have it returned upon their hands. The ballast was evenly distributed in either greater or lesser quantities as was desired, for the hopper can be set to deliver quickly according to requirement. Another use for this machine is the distribution of gravel on macadam roads in order to maintain the supply of bond material.

FACTORY NOTES.

ON Monday new boiler works were opened with modern machinery by Mr. George Stansfield on the site of the old gas-works at Maryport.

SYDNEY EXHIBITION.—Messrs. E. P. and W. Baldwin, tin-plate manufacturers, of Wilden Ironworks, Stourport, have been awarded a gold medal at this Exhibition.

THE TIN TRADE.—On Monday the Cornish smelters reduced the tin standard £4 per ton. The standards now are —superior common, 78s. ; superior fine, 79s. per cwt. The mine share market was flat.

THE PATENT PLUMBAGO CRUCIBLE COMPANY.—This Company, whose works are at Battersea, has just taken over the business of the Messrs. Juleff, manufacturers, at Redruth, of the original Cornish crucibles, an industry which has been carried on by their family in that town for more than a century.

NEW STEEL WORKS AT BARROW.—Mr. S. J. Claye, of the Barrow Railway Rolling Stock Works, has this week commenced his Bessemer department, in which he not only proposes to produce the ordinary class of steel, but to supply his own works with the large amount of steel goods required for wheels, springs, axles, &c.

THE BUILDING EXHIBITION.—In our notice of this exhibition we stated that Mr. Tighe Hamilton's dovetailer was exhibited by Messrs. Howard and Sons, of Oxford Street. Messrs. M. Powis, Bale and Co., of 20, Budge Row, London, write us to say that it was exhibited by them, as sole agents, at Messrs. Howard's stand, to show some of the work it had done.

THE PERSEVERANCE WORKS, SHREWSBURY.—Messrs. Corbett and Peele, the proprietors of these extensive Agricultural Engineering Works, and who have gained several important prizes at the Sydney Exhibition, including the medal for best winnower and cheese press, have just issued an illustrated catalogue of their improved patent agricultural implements and machinery, in which several important improvements have recently been embodied.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending 24th April :—On Monday, Tuesday and Saturday (free), from 10 a.m. to 10 p.m., Museum, 11,589. Mercantile Marine, Building Materials, and other Collections, 2168. On Wednesday, Thursday and Friday (admission 6d.) from 10 a.m. till 6 p.m., Museum, 2260 ; Mercantile Marine, Building Materials, and other Collections, 163. Total, 16,180. Average of corresponding week in former years, 15,710. Total from the opening of the Museum, 18,881,280.

METAL TRADES PENSION SOCIETY.—In their annual report, the committee of the Iron, Hardware and Metal Trades' Pension Society state that notwithstanding the great depression that has existed in all branches of the iron, hardware and metal trades, the ordinary income of the society has not diminished, and at the same time the expenses of management show a reduction of about £36 in comparison with the preceding year. While, however, congratulating the subscribers on the prosperous condition of the charity, the committee cannot too strongly impress upon them the great necessity of increasing its income, so that its benefits may more fairly represent the iron industries of the country. During the past year the sum of £3006 18s. 7d. has been paid in pensions, making a total since the foundation of the society of £57,594 6s. The number of pensioners now receiving relief from the funds of the society is 144, including twenty elected during the year, and in the same period twenty-one have died.

THE CUMBERLAND COAL TRADE.—The report of the accountants under the sliding-scale arrangement shows that the realised price of coal in Cumberland has increased more than in any other district where the price is similarly ascertained. For the quarter just ended the price of coal has been verified at 5s. 2.99d. per ton, an advance of rather more than 8d. per ton since the scale was agreed to. The increase of wages that would have followed has been anticipated, so that no change follows the return of the accountants. With the higher value there is a much larger demand for coal in Cumberland, not only for the Irish market, but also for home consumption, especially at the forges and blast furnaces. The consumption of fuel for these purposes is now at its highest in the district, the number of furnaces in blast being higher than for many years ; and though a large part of the coke used is drawn from the western part of Durham, yet there is a successful attempt to commence the coke trade in Cumberland, for which purpose the quantity of coal used is growing. It is expected that the next return of realised prices under the scale—that for the quarter now current—will show a further increase, and one sufficient to cause, under the arrangement, the rate of wages to be again advanced.

THE LONDON COAL SUPPLY.—As the metropolis is increasingly supplied with coal by railway, there is special interest in a statement of the quantity brought into the metropolitan district during the first quarter of the present year. It appears that the coal traffic to London is almost exclusively in the hands of five great companies, at the head of which stands the Midland Railway. In the first three months of the present year this company brought in 522,978 tons of coal—an increase of about 19,000 tons over the quantity for the corresponding quarter of last year. The London and North-Western brought in 372,616 tons—a decrease of 12,000 tons. The Great Northern follows with 259,173 tons—a falling off of 56,000 tons. The Great Western brought in 249,321 tons ; and the only other large contributor to the metropolitan coal supply is the Great Eastern, which brought 179,387 tons. Some other lines brought in an aggregate of 21,561 tons ; and thus the quantity for the quarter is 1,605,036 tons, while for the corresponding period of last year 1,659,816 tons were bought in. Unquestionably the smaller tonnage brought by rail is not due to larger quantities of sea-borne coal, and it seems doubtful whether there has been any increase in price sufficient to check consumption ; so that the reduced importation may be largely ascribed to the less inclement winter that has passed than that with which it compares.

MANCHESTER STEAM USERS' ASSOCIATION.—On Tuesday last, at the ordinary monthly meeting of the executive committee of this association, held at the offices, 9, Mount Street, Manchester, Mr. Hugh Mason, M.P., president, in the chair, Mr. Lavington E. Fletcher, chief engineer, presented his report, which gave particulars of visits of inspection and a record of boiler explosions from the 1st of January to the 23rd of April inclusive. In the period stated 2129 visits of inspection were made, and 3777 boilers examined; 2586 externally, 19 internally, 19 in the flues and 153 entirely, while in addition 20 boilers were tested by hydraulic pressure; three of these hydraulic tests were applied to boilers that had already been in use, to ascertain their fitness for the pressures proposed to be carried, while in the other 17 cases the boilers were new ones, and were tested not only by hydraulic pressure but also especially examined, both as regards their construction and complement of fittings before leaving the maker's yard. During the above period the following defects have been met with :—Furnaces out of shape, 19; fractures, 49—one dangerous ; blistered plates, 21 ; internal corrosion, 56 ; external ditto, 85—one dangerous ; internal grooving, 66 ; external ditto, 2 ; blow out apparatus out of order, 5 ; safety valves ditto, 8—2 dangerous ; pressure gauges ditto, 111 ; boilers without pressure gauges, 3 ; without blow-out apparatus, 5 ; without feed-back pressure valves, 16 ; cases of over pressure, 1 ; cases of deficiency of water, 1 ; total defects, 448—4 dangerous. The present year, as stated in the president's remarks at the annual meeting, has opened badly as regards the number of persons killed, and though the loss of life in 1879 was less than the average of the last fifteen years, the present year threatens to make up for it. Already eight steam boiler explosions have occurred, killing 33 persons and injuring 32 others ; while in addition, by the bursting of a tar boiler, 11 persons were killed and 6 injured, making a total of 44 persons killed and 38 injured from the 1st of January to the 23rd of April. Not one of these explosions arose from boilers under the charge of the Manchester Steam Users' Association.

AMERICAN GLEANINGS.

END OF THE "IRON BOOM."

THE news which we print this week on our first page and elsewhere in our market quotations (says the *Bulletin of the American Iron and Steel Association*, of April 14), records the important fact that the "iron boom" which has existed in the United States since July of last year has come to an end. The climax of excitement and speculation was reached in February, and since then prices have been gradually weakened and orders decreasing. Two leading causes of the turn in the tide have for some time been operating with full force ; one of these was increased production, and the other was largely increased importations. Sooner or later these influences would be master of the situation. The country could consume so much iron and no more. So long as the supply was below the demand prices continued steadily to advance ; when it became equal to the demand, or exceeded it, prices had to fall. The heavy importations of January, February and March overloaded the market in some lines, the prices at first weakened and then went down with a run. The decline in pig-iron has been $10 a ton ; in bar iron from 4 to 3 and 3-10ths cents a pound ; in old rails from $45 to $35 a ton ; in new iron rails from $67 to $60 a ton ; in steel rails from $85 to $75 a ton. Prices have correspondingly declined in British markets ; or, more correctly, it was the decline in prices in British markets in order to effect sales on this side that caused the decline here. The latest advices from the other side indicate a good deal of demoralisation in English and Scotch markets.

The problem to be worked out by the iron and steel manufacturers of this country during the present spring and coming summer is a very simple one. A large quantity of iron and steel will be required by our new and old railroads, our Western farmers and other consumers. No man needs to lie awake at night worrying about a possible decline in the consumption of iron and steel. There will be no such reaction. The country is prosperous, and it is going to stay prosperous for a long time to come. Who shall supply it with iron and steel—the domestic manufacturer or the foreign manufacturer? This is the problem to be solved. All other troublesome questions in the iron trade have been disposed of or are comprised in this one.

Our manufacturers, if they would entirely supply the home market, must meet the foreign prices, adding the duties and other costs of importation. True, foreign iron is not, as a rule, equal to American, but nevertheless the prices at which it can be laid down on our wharves must be met by domestic producers. Fortunately the tariff will for the present remain undisturbed ; but, unfortunately, our late necessities have started up idle mills and furnaces in Great Britain, the owners of which will strive hard to sell their product in our market. Ours is the only considerable foreign market they have to depend upon.

The owners of our rolling mills and furnaces, having lowered their prices, have taken the first step toward reclaiming the home market from foreign hands. They have done the right thing not a moment too soon. They must now be supported generously and manfully by the manufacturers of coke and the miners of iron ore. Both ore and coke are unreasonably high in price to-day, and are out of all proportion to the prices of iron and steel. We confidently believe that those who have them to sell will come to the aid of their customers. If they do not do this they will simply kill the goose that lays the golden eggs. Notwithstanding the tariff, foreigners will continue to supply us with their iron and steel, and many of our furnaces and mills will be again closed if coke and ore remain where they are.

THE fifteen car manufacturing establishments of the United States turned out last year 37,350 pieces of rolling stock.

THE first iron works in America were erected in 1619, at a place called Falling Creek, a branch of the James River, nor far from Jamestown, the first settlement of the Virginia colony, thirty-two miles from the sea.—*Mining and Scientific Press.*

COLOUR BLINDNESS.—Examinations of the employes of the Pennsylvania railroad have been begun at Jersey City, and it is stated that the directors have decided to order a test of the eyesight of all engineers, firemen and brakemen. The first test used is for acuteness of vision, a test card with letters in small types being employed. The subject is next tested as to form and distinctness, by directing him to look at a ¼-inch aperture in a screen 20 feet distant with a strong light behind it, and then calling upon him to state in what shape it appeared. The test, however simple it may appear, is by no means so to some of the subjects. What appeared oval to one of the candidates examined the first day seemed triangular to another, and *vice versa*. The colour test is next proceeded with; skeins of coloured yarn being used in the manner which has often been described in these columns. We understand that the first day's examination discovered sixteen cases of defective colour sense and others of a vision defective in other respects. This proves conclusively the prevalency of colour blindness among railway employes and the necessity of such examination. It is sated that other large Eastern roads are intending to institute a system of tests.

The Labour Market.—Trade matters are pretty quiet just now. Mr. David Dale, the arbitrator in the wages question in the North of England manufactured iron trade, gave his award on Saturday in connection with the sliding scale to regulate wages, which will come into operation on the first of next month. An advance of 12½ per cent. was given the ironworkers some time back, and a sliding scale, subject to the arbitrament on the question of the basis of such scale by Mr. Dale, was arranged. The question submitted to the arbitrator was, whether the basis of the sliding scale should be 1s. 3d. or 1s. 6d. above shillings for pounds on the average net selling price of iron. Mr. Dale awards that the rate of wages shall run on 1s. 6d. above shillings for pounds long weight. The sliding scale which is thus fixed for the finished-iron trade will last for two years. On the same day, a deputation from the Cleveland ironstone miners met the mineowners at their office, Middlesborough, with respect to the wages of the men, and the working of the sliding scale. The sliding scale adopted was to regulate the wages of the men according to the rate at which No. 3 pig-iron was sold in the market. The scale has now been in operation six months. The price of iron ascertained for the quarter ending December was 36s. 7·94d. (36 shillings 7 decimal 94 pence) per ton; and for the first quarter of 1880 the average ascertained price was 42s. 8·57d. per ton, being an increase of 6s. 0·63d. per ton on the previous quarter. Had the employers not given an advance of 10 per cent. when the scale was adopted, the scale itself would have given that amount in two advances—2½ per cent. at the beginning of January, and 7½ per cent. at the beginning of April. The meeting lasted from eleven o'clock till nearly two, but no resolutions were passed. The representatives of the men afterwards held a meeting at the Alexandra Hotel, Middlesborough, when it was decided to advise the men to adhere to the sliding scale. On the assumption of an improved state of trade, the boilermakers and iron shipbuilders connected with the union have in several centres asked for an advance of wages; but we are informed, upon reliable authority, that the employers on the Mersey and the Clyde, and at Manchester, Liverpool, and other important centres, after holding meetings to consider the matter, have come to the conclusion that the condition of trade in no way warrants an advance in wages at the present time. As bearing out this conclusion, it may be stated that an investition of the state of the iron shipbuilding and marine engine trades shows that there are at present extremely few new orders coming in, and that, as a rule, where establishments appear to be busy, they are simply employed finishing work which has been some time in hand.

IRON AND COAL TRADE REPORTS.

BARNSLEY AND SOUTH YORKSHIRE.—The house-coal trade of this district, on which so many extensive and costly collieries have for the most part to depend, is in a very quiet state. During the past three years coal owners here have expended fabulous sums of money in the opening of collieries, which for some time have been worked to a loss rather than a profit. For some time the state of the house-coal trade has been an exceptional one, but during the past month or two it has been reduced to the lowest ebb. The reports received from the representatives of the various collieries at Barnsley on Wednesday were of a most discouraging nature. The demand for the metropolis, on which so many of the large collieries depend, is of the most meagre character. The quantity of both Silkstones and Barnsley house-coal, which is being forwarded to Doncaster, *en route* by the Great Northern to London, is very moderate indeed, whilst the Midland is only conveying a limited tonnage. As stated in our last notice, a large mass meeting was held on Monday at Mexborough, the centre of an important colliery district, in favour of the Hull and Barnsley Railway, and the Royal Commission of enquiry into the rates charges for conveying coal and iron from the district to London and other markets as compared with those to other places. There is rather more doing in gas and house coal for the Eastern counties than was the case a short time ago, but local sales are quiet. The steam-coal trade is rather better, and more is expected to be done when the Baltic ports are thoroughly open. The exports from Grimsby last week show a slight falling off, but there was an increase from Hull, to which district a good deal of South Yorkshire coal is being sent, although the rates are fully 1s. per ton higher than they are from the West Riding coalfield. Great attention is just now being paid to the contracts for locomotive and gas coal. Those for the Midland Company terminate on the last day of June, and it is understood that the tenders sent in from this district will be pretty uniform with respect to prices. Several important tenders for gas-coal will be decided in the course of the coming week, and are being actively competed for by South Yorkshire coal owners. The sale of small coal and slack is about the same as when last noticed, but there is less difficulty with regard to it than was the case before the coke trade revived. That class of fuel is, however, decreasing in price, whilst the demand is not so good, owing to the large output which is taking place. In no district in the United Kingdom are there so many ovens for coke making purposes in the course of erection as in South Yorkshire, and in addition to those already noticed tenders for the erection of fifty new ones have been opened during the week, which are intended to be erected at a district colliery. By far the largest portion of what is made is forwarded by rail to North Lincolnshire, where the output, notwithstanding the decline in prices, keep well up. Although the state of trade is in such an unsatisfactory state the new undertakings with which the district abounds are developing their working and plant. There are now nearly 200 men at work at the Fitzwilliam Hemsworth Main Colliery (Limited), where the workings are being considerably extended and improved. The Great Houghton Colliery has just completed one of the finest head gears in the district, embracing all the most modern appliances. The company have also covered the pit hill and screens with a light and beautifully constructed iron girder roof. The iron trade exhibits but little alteration, and it must be admitted that in some of the branches devoted to finished goods business is not over active. The works at Thorncliffe, so well known for the manufacture of of gas and cooking materials, are pretty well off for orders. There is also a fair amount of work for puddlers and mill hands at the Milton and Elsecar Works The Yorkshire Steel and Iron Works at Penistone are doing pretty well in the make of Bessemer steel rails, tires and axles. All the district furnaces are kept at work, so that the output of pig-iron is fully an average one. But little ironstone is being got in the district, the supplies being for the most part got from North Lincolnshire. It may, however, be stated that several thin seams of ore have been met with in the gannister quarries, on the Yorkshire Moors, and are being got and smelted with foreign ironstone in the district. The foundries are, on the whole, not over busy, the chief of the orders on hand relate to colliery work and local repairs.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—There is a very quiet demand for hematite pig-iron, and recent sales have been very limited in extent and few in number. There is, indeed, every indication of a quiet summer, so far as new orders are concerned, but makers have sufficient work in hand to keep them well employed for some months to come. The market in America and the Continent seems to have been glutted with iron, and home consumers are not wanting many deliveries beyond those contracted for a few months ago. Bessemer qualities of iron—all-round samples—which three months ago could scarcely be purchased at £6 10s. per ton, are now, it is affirmed on good authority, being disposed of for under £4 per ton. Many makers are declining to quote at all, and it is generally thought that the decline in value and in demand is only a rebound which was necessary after the high prices and heavy demand of a few months back in order that the markets could be brought back to a sound level, for it cannot be claimed that the experience of the past few months has been of a character which would induce confidence in commercial circles. The rocket-like tendency of prices was an unhealthy sign, and a reaction must be expected. This, to some extent, has already shown itself, but it is believed that the downward tendency will soon receive a check, and that a better demand will shortly present itself. Steel makers are busily employed, but have not during the past few weeks booked many orders. There can be no doubt, however, that for several months to come there will be considerable industrial activity in the steel trade, for the orders held for rails and merchant qualities of steel are sufficient to ensure a full work almost to the end of the year. Iron shipbuildess are also busily employed, and a vast amount of work is in progress. There is not, however, any demand at present for iron ships. Engineers and iron-founders are busily employed, as also are those who are engaged in the various minor branches of industry. Iron ore weaker at from 20s. to 23s. per ton at mines. Coal steady.

BIRMINGHAM.—Hardware manufacturers have experienced a little more movement in trade, both as regards foreign markets and the home demand. Gradually orders are coming to hand from Canada and the North of Europe, although the influence of foreign competition is still severely felt. The South American demand, which has been active recently, shows symptoms of declining the result doubtless of overstocked markets. American orders are scarcely equal in volume to those received during the first months of the year, but they contrast favourably with the average of the corresponding period of last year. Trade is especially brisk in tin-plates, sporting guns, needles and buttons. Shipments to the Cape are steadily maintained, edge-too makers being fairly engaged for this market, and also for the West Indies and South America, although contracts of some magnitude for the cheaper classes of tools have recently gone to manufacturers in other towns who have quoted lower prices. Only a moderate trade is being done with British India just now, and there is a wide margin for improvement in the demand alike from New Zealand and Australia. France has recently been taking considerable quantities of high-class machinery for harvesting purposes. At home the prospect has become more encouraging, the influx of orders from the North of England and Scotland being steadily maintained and showing a progressive advance. From the principal towns throughout the country, there is a fair supply of orders for garden tools and furnishing ironmongery, and travelling trunks are in better request. For the period of the year, baths and toilet ware are scarcely in average demand, while builders' ironmongery and brassfoundry fail to go off at all freely, and the stocks in retailers' hands are reported heavy. In comparison with last quarter the home request for edge-tools exhibits improvement, but trade is nevertheless quiet. Metal rollers are experiencing the effects of a reaction following upon the activity of the opening months of the year, which was, it seems, mainly attributable to a speculative demand. Wire is selling fairly well, but tubes are only in limited request. The makers of fenders and fire-irons, especially those who turn out the lower quality of goods, find trade dull, but this is usual just at the present time of the year in this branch of local industry. One of the most satisfactory features in connection with the movement in trade during the past week or two has been the very marked indication of improvement in the agricultural districts, in which the favourable weather appears at last to have exercised some influence. Implements, galvanised iron, fencing, tools, nuts and bolts are all reported to be in decidedly improved request. Safe and strong room manufacturers are doing a better trade than is usual at the spring of the year, and the improvement already noted in japanned and tin-plate goods and hollow ware is fairly sustained. Galvanisers are somewhat more slack, and lock manufacturers are not at all fully employed, while prices in all those branches in which competition is most keen, show a tendency to weakness. The local iron trade continues in an inanimate condition. The pig-iron market is considerably depressed in consequence of the limited contracts which were placed at quarter-day, and the increase which has recently taken place in the output. The result is that prices of the medium and lower qualities are very weak. Most of the best firms in the wrought iron trade are still employed on export orders booked early in the year.

Thursday Evening.—Market to-day flat, and prices of commoner qualities declining. Bulk of American orders placed in the district being now completed, manufacturers are anxiously looking for renewals to keep works employed. Marked iron has undergone no change, being steady at £9, but unmarked is fully 5s. lower than at last quarter-day. Stocks of pig-ron are getting heavy, and prices are proportionately weak. Some samples of coal from the new twenty-four-foot seam discovered at Hamstead Colliery, shown on Change to-day, have attracted considerable attention.

CLEVELAND.—The downward run in prices of pig-iron seems for the present to be arrested. On Tuesday prices had begun to rally and since then they have stiffened considerably, having advanced from 37s. to 38s. 6d. Many makers will not sell at less than 40s. Forge, as hitherto, fetches as high a price as foundry iron owing to the scarcity and the demand. During the recent brief panic outside holders of iron, getting alarmed, sold several lots at a very low figure it is said. Buyers are now more numerous and sellers scarcer. Manufacturers of finished-iron have now their opportunity and are beginning to take advantage of it though it was generally considered that a lower figure would be reached. There is a good deal of iron going away so that there is little or no dread of an accumulation of stocks, but the American prospect being overcast has thrown an uncertain gloom over the future. In Connal's stores alone, however, there has been a decrease of 24,000 tons since the beginning of the present decline. The finished-iron trade is still brisk, but its prospect is perhaps not so bright as it was some time back. The fall in pig must stimulate the market so that we may look for some revival of orders. The collateral industries are doing a fair amount of work. Coal is much about the same, but coke is in poorer demand and has fallen 6d. per ton.

DERBYSHIRE.—The coal trade in this district, although quieter than it was a short time ago, is better than in some parts of the Yorkshire coalfields. Large contracts being on hand for London and other markets, some of the pits are forwarding a good tonnage over the Midland Railway. The demands for local requirements are quiet, but there is a fair business doing in steam-coal for smelting and exportation. Gas coal is in request, and some large contracts for Derby and Notaingham will be decided next week, and will doubtless be found to have evoked considerable competition. There is only a moderate inquiry for small coal and slack, but the sale of coke holds well up, prices, it is true, having declined a good deal. It may be noted in passing that the recent elections have rather seriously affected some of the directors on the board of the Midland Railway, but the number of M.P.'s on the board remains unchanged. although several of the old directors have lost their seats. The iron trade is scarcely so active as it was a month or two ago, buyers evidently thinking that the present declining rates have as yet not found their lowest pitch. All the available furnaces are in blast, and two at Wingfield will doubtless be added in the course of a week or two. One is to be fitted with hot and the other with cold blast. The company, as stated last week, will not only supply all their own coke, but they will be able to mix their own ore got in the Flockton seam of coal at three pits near Barnsley, with other ironstone in their cold-blast furnace. There is very little alteration to note with respect to the work doing at the foundries. The rail and plate mills are kept fairly going, there being a tolerable demand for merchant and other kinds of iron. The Midland Counties Miners' Relief Fund is still progressing, having during the last quarter opened two additional local agencies.

DURHAM.—The iron trade within the last few weeks has been in a somewhat excited condition, especially in relation to the dealings in pigs. The weaker second hands were, especially towards the end of last week, rushing in to clear themselves of their holdings, and generally it is believed managed to effect this, especially in those cases where iron had been bought by those outside the trade, who dabbled considerably at one time in speculative purchases, and have generally got their fingers burnt in consequence. Indeed, it is said, that some of these parties, many of whom reside at a distance, have sold at 1s. per ton below the lowest figure registered in the Cleveland market. When things get to their worst they are said to be likely to mend, and it is hoped that the bottom has been touched. Indeed, since Monday, there has been a reaction in favour of higher rates, and very little iron can be got from merchants for less than about 38s. No. 3, some ask more. The makers have been offering small lots at 41s. As to the finished-iron branches they remain in about the same condition. The prices obtainable are now however, greatly reduced. Firms of course well off for work do not quote any lower rates. In other cases, however, £6 10s. to £6 12s. 6d. would be taken for bars and about the same for angle iron, with £7 10s. to £8 for ship plates, the less commision. Puddled bars £4 15s. to £4 18s. 6d. net. Mr. David Dall, of Darlington has settled the basis of the sliding scale in the manufactured iron trade of the North of England by an award made this week, fixing the amount to be paid as shillings for pounds 1s. 6d. per ton over. He thus sustains the claim of the workmen. The employers offered 1s. 3d. The men held for 1s. 6d. The average net selling prices by which the sliding scale will be fixed may be expected soon. The new rule will come into operation from the first of May. It is considered not improbable that something may be done in the way of arranging a scale which will operate equally to regulate wages in the North of England as well as in Staffordshire, as was done some years since. The steel makers are kept pretty well employed, but prices of hematite iron and steel has declined considerably, The foundries are not very well employed. Collieries are steadily going. Manufacturing coals are not much changed in value, though there is a slight downward tendency. Coke is now offered at less money from 13s. to 14s., delivered at the Cleveland furnaces. The coke ovens are kept very busy as there is a large quantity required for the West Coast as well as for the Cleveland district.

FOREST OF DEAN.—Immediate prospects in this district are surrounded by gloom and doubt, and there are few signs of revived trade. Regarding the staple industry, the Cinderford Valley pits alone are doing any trade worthy of consideration, and here the improvement has been purchased at the sacrifice of recent quotations and stoppages elsewhere. The leading collieries of Cinderford district are therefore making very nearly full time. The prospect of restarting in West Dean is still characterised by doubt and misgivings. An interview took place a few days ago between the manager, Mr. Thomas, and some of the men, but with no practical issue. One of the results of the prolonged suspension is severe suffering among the families of the unemployed men, the wives of whom, to a considerable extent, on Saturday waited upon the Monmouth Union Guardians, whose generosity may be gathered from the fact that the women were kept for a period of four hours out in the cold, after marching a distance of twelve miles, and then got no help. To-day, it is stated, that relief works, in stone breaking, has been, under the auspices of the guardians, started. Mr. Nicholson, who has nobly aided the unemployed, has become so disheartened with the guardians, who pooh-pooh the distress, that he has temporarily left the Forest, leaving the authorities to deal with the people as they may determine. The district iron trade is less hopeful and there are rumours as to an early blowing out of one of the furnaces belonging to Messrs. Crawshay Brothers, who, since the revival, have been working three out of their four furnaces. This has been brought about by the falling off in the demand for Forest pig, and the increased stocks in hand. It must be clear and patent now they were correct in declining to recognise the justice on the part of their miners in the demand made for successive advances at the fall and beginning of the year. It is hoped that for the present there may be no diminution in the operations at their iron mines. The sudden bound of trade at the autumn of last year ought to teach that the iron industry is subject to such visitations, and reasonable stocks at any iron mine are always worthy of consideration. There are practical people here who still hold to the opinion that the iron trade will recover itself as the summer advances, and everybody interested in trade will hope such anticipatians may be verified. The fall in quotations of pig will be rather surprising to local tinplate makers, because in some instances heavy stock of pig-iron have been secured, and it is hardly reasonable to believe these altogether could be purchased at the old low rates. The tinplate industry is less active. At Lydbrook Messrs. Richard Thomas and Co. are increasing their facilities in production, and are improving their extensive mills. An incident in connection with the Severn Bridge is coming off on Saturday, to which will be attached considerable interest to engineers in general and to Mr. G. W. Keeling in particular. Gentlemen of trade in the Forest and others desiring to show their appreciation to the engineer of the beautiful bridge now spanning the Severn have subscribed to a testimonial which, apart from the pleasure it must afford, is of a valuable character and will be a work of art.

GLASGOW.—The warrant market has been very flat during the past week; holders of iron have shown great anxiety to realise, and large parcels have been thrown upon the market, and values have been constantly depreciating. Latterly there has been some good buying, which produced a slight reaction, but prices have again given way, and are generally expected to go still lower, as there is almost no demand for iron for shipment on home consumption, and the production is so enormous. On Thursday 49s. 4½d. to 48s. cash and 49s. 7½d. to 48s. 3d. a month was accepted. Next day business took place from 48s. 3d. to 46s. 9d. cash; on Monday opening flat, at 45s. 7½d. 14 days and 45s. 9d. a month a rally took place to 46s. 9d. cash and 47s. a month. On Tuesday up to 47s. 6d. cash was paid, and on Wednesday large transactions took place from 48s. 3d. cash and 48s. 6d. a month to 47s. 3d. and 47s. 6d. cash a month. Closing sellers, 47s. 3d. cash and 47s. 6d. a month; buyers, 1½d. per ton less, Several makers have made reductions in their prices, bvt the demand has not been stimulated in the least, No. 1 Gartsherrie is now 55s., No. 1 Eglinton 50s. per ton, the shipments of pig-iron from Scotland last week were—Foreign, 11,968 tons; coastwise, 4313 tons; total, 16,279 tons, against 11,795 tons in the corresponding period of last year. The imports of Middlesborough pig-iron into Grangemouth last week were 2750 tons, against 1880 tons in the similar period of last year. The total imports till April 24th, 1880, are 72,343 tons, against 81,587 tons till April 26th, 1879, showing a decrease for this year of 9247 tons. Little change has taken place in the stock of pig-iron in Connal's store during the week, the amount is now 437,356 tons. The manufactured iron trade is quite inanimate. As the old orders are being rapidly worked off, new orders cannot be got to replace them, there is therefore great competition, and very low prices are being quoted for good specifications. The exports last week were again small, the chief items being for Canada, wrought iron valued at £5313; for the Continent, machinery valued at £6445; for Bombay, locomotives valued at £4860; for the United States, wrought iron valued at £1035, and for Natal, cast-iron valued at £1279. During the week orders for six large steamers have been placed with Clyde shipbuilding firms, several of these vessels are to be built almost entirely of steel. It is reported that negotiations are going on which will likely result in a few more orders being given out in the Clyde. The engineers and founders are doing a quiet trade, but there is not much new inquiry at present. The coal trade still shows no sign of improving, and the demand both for shipping and house purposes is very small. In most districts the miners' wages are being reduced with but slight opposition.

LANCASHIRE.—The iron trade of this district continues in a very unsettled condition, and during the past week there has been a further considerable fall in prices. There was, however, if anything a rather better tone at the Manchester meeting on Tuesday, as compared with the previous week, and although the amount of business actually done was very small there was more disposition to buy; some considerable enquiries were made by local consumers for iron delivered over the year, and these resulted in one or two lots being placed. In Lancashire pig-iron the downward movement in prices has continued during the past week, and local makers are now willing to take about 55s. to 56s. per ton for foundary and forge iron delivered into the Manchester district, but even at these figures they are only able to secure extremely few orders, and the bulk of the iron going away from the works is still being delivered on account of old contracts. Lincolnshire brands can be bought at about the same price as local iron and Derbyshire iron is also being quoted at considerably lower figures than those which were ruling a week or two back, but as yet there are not many of the makers who are actually pressing for sales, and the business doing is little more than nominal. Scotch and Middlesborough irons are the outside brands which at present are chiefly enquired for in this district. In No. 3 Glengarnock delivered into the Manchester district 61s. to 61s. 6d. per ton is being asked, and good Middlesborough brands are reported to have been sold at about 45s. 6d. to 46s. per ton net cash. The manufactured iron trade is very dull and inactive and very few orders are being placed with makers, whose prices are unobtainable in the face of the underselling now being carried on by merchants. As a rule the forge proprietors in this district are still well employed, many of them having orders on hand which will carry them over the next two or three months, and for bars delivered into the Manchester district they are quoting about £8 per ton, but second-hand lots are to be bought at 10s. to 15s. per ton under this figure. Cotton machinists and boiler-makers are generally busy, but general engineers and founders as a rule are slack with very few enquiries coming to hand. There is but little change to report with regard to the coal trade. Round coals still move off very slowly for home consumption and low prices have to be taken, but there has been a rather better demand for shipment abroad, and a good deal of stock has been cleared away from some of the collieries. For engine classes of fuel a good demand is maintained and sellers are firm at full prices. The average quotation at the pit mouth may be given about as under: Best coal, 8s.; seconds, 6s. to 6s. 6d.; common round coal, 5s. to 5s. 6d.; good burgy, 4s. 3d. to 4s. 6d.; and good slack, 3s. 9d. to 4s. per ton.

LEEDS AND WEST YORKSHIRE. — All branches of the iron manufacture in this town and district are steady, at about the point of moderate activity which has been indicated in these reports for several weeks back. That this will be fully maintained up to Whitsuntide is quite certain. At some of the forges it may be found necessary meanwhile to put on an extra spurt in order to compensate for that approaching holiday. Now that a calmer spirit has come over the market, it is thought that a better and more constant demand for all sorts of manufactured iron must arise before long. Even merchant iron will be none the worse for the recent convulsions, and especially the more famous and extremely select brands, for which this district is peculiar. All kinds of best Yorkshire bar and contractors' iron will undoubtedly be at a much greater advantage than those ordinary sorts which have of late been so much tampered with by undiscriminating operators. It is gratifying to find that after a considerable interval since the last orders of any weight were received, at length there are more fresh requisitions for boiler-plates. This time the orders are said to be derived solely from shipbuilding firms. There appears to be good prospects of renewed orders for railway rolling plant in a few weeks hence. Every forge in the district is on the alert for any immediate accession of business, and in some instances new blood has been infused into the management, which will duly assert itself whenever there is any heavy pressure of business. The common iron makers are making full time on old orders, and some of them have accepted special specifications, which, in the execution, will absorb large quantities of scrap and other old iron. One firm has made a good bargain in respect of a large lot of old colliery tram rails. All our engineering establishments are fairly off for work, and for at least three years makers of heavy tools, machinery, indispensable to large mining, sanitary and public works of construction generally, have never been so busy as they are at this moment. It is the variety of heavy and first-class work of this kind which shows how largely the requirements—both home and foreign—have increased, and are increasing in this department. Many of these orders are in connection with the new development of steel conversion. For large type of locomotive engine there is a good market. As the year advances it is scarcely likely that there will be less doing in this branch tnan there is at present. Textile manufacturers are beginning to order new machinery. The cut-nail trade is brisk, with the never-ceasing accompaniment—much grumbling—at prices. In the coal trade there is no more animation than hitherto. It has almost become the normal condition of the collier to work four days one week and three the next; and with this he has by this time accustomed himself to be content. The export trade is quite as lifeless as the home; and it is almost superfluous to say that prices as such as barely to say expenses.

LONDON.—The metal market remains dull and prices are easier all round. To-day however, some descriptions have shown a better spirit, and there are certainly some big bonâ fide buyers operating which no doubt will tell upon prices shortly. Iron pigs are quiet 46s. 6d. Scotch warrants: Manufactured iron easy. Cpper slightly improved. Chili bars £60 spot. Tin, a better feeling is taking hold of this metal. There have been eager buyers to-day, £80. to £80. 5s. English ingots £85. Lead quiet with rather easier rates. Tin plates: low prices are ruling at moment, but improvement is anticipated.

NEWCASTLE AND THE TYNE DISTRICT.—Owing to the recent panic in the iron trade, quietness and caution seem to hold sway over business men in this district; but there is little or no diminution of activity in our leading industries. This is abundantly testified by the fact that the traffic returns of the North-Eastern Railway Company, the bulk of whose revenues are derived from the Tyne, Wear and Tees districts, show an increase of £31,226 in the week ended on Saturday last, the gross receipts for the week being £93,828 in 1879 and £125,054 in 1880. The coal and iron trades contribute a large proportion of this sum; and therefore we may be assured that as far as *bona fide* trade is concerned, there is no ground for alarm in the tremendous fall in the price of iron in the open market. Another matter of encouragement is the fact that whilst the action of speculators has brought down the value of pig-iron about 15s. per ton in little more than a fortnight, the ironworks are at the present moment quite as busy as they were a month ago. It is the general opinion here now that in a few weeks the market will steady itself, and that makers are right in keeping up their prices, about 10s. per ton above the merchants' figure, in the meantime. On Monday sales were reported as low as 36s. 6d. for No. 3, but at the time of writing 38s. is the lowest quotation. The rates for manufactured iron of all descriptions have further given way a little, and in some quarters it is hoped that the reduced cost of material may enable iron shipbuilders to get more work under contract for the latter months of the year. Ship-plates can be sold for £7 15s. to £8 here, and angles at £6 12s. 6d. to £6 15s. Boiler-plates are worth £9 7s. 6d. to £9 10s. per ton, and bars £6 15s. to £7, less the usual commission. Foundries and forges are as a rule well employed at present, although at some establishments fresh orders do not flow in so quickly as was the case a few weeks before the commencement of the iron panic. Work is in a satisfacfactory state in the ship-yards, and they are receiving large deliveries of iron. Messrs. A. Leslie and Co., at Hebburn, have several vessels well forward, and not a vacant place in their yard. At Messrs. C. Mitchell and Co.'s there are nine vessels in progress, and the firm has orders for as many more. In a few days the Tyne Shipbuilding Company will launch a vessel, and they have others in the earlier stages. Some very large vessels are in course of construction at Messrs. Wigham, Richardson and Co's. building yard at Low Walker, and besides some of their departments working overtime in order to push forward the work, they are frequently taking on fresh hands. At most of the other establishments there is the same healthy appearance of things. Large numbers of workmen have been attracted here of late from distant parts of the country, and when found suitable they have on the whole been successful in getting employment. After a considerable decline in prices of chemicals, the market having been in a state of semi-panic for a few days, rates have again rallied. Soda ash is quoted 1½, less 5 per cent., and bleaching powder £6 nett with other articles in proportion; but as the market is gradually stiffening it is difficult to fix quotations. The coal trade is quiet, owing probably to the upper Baltic ports not being fairly opened. The steam-coal mines are being worked regularly, but there is still an absence of pressure, and loading turns are short. For the best steam-coals the quotation remains at 10s. per ton less 2½ per cent., but they can be obtained on easier terms for immediate shipment. Gas and manufacturing coals are in good demand, and recent prices are tolerably well maintained. Coke is easier to buy. Business in house-coals is depressed, with no prospect of a change for the better. Fire-bricks continue in request for export, and an upward tendency is observable in prices, but the top quotation of 50s. per thousand remains current. Cement manufacturers have orders on hand sufficient to keep their factories in full work for month or two, and prices are firmly maintained. Engine works are for the most part busy.

NORTH STAFFORDSHIRE.—The condition of trade in this part of the country is in no degree better than at the time of our last report. A considerable quantity of iron has been lately thrown into the market by speculative buyers who acquired in the early stages of the recent improvement before prices were advanced, and are now able to offer at rates below makers' quotations. This will, of course, continue to affect both figures and business as long as the stocks hold out; but if nothing stood between producers and customers the trade would be still in an unsatisfactory state, as the demand seems to have declined almost to the point of suspension. Not only is this the case in regard to the home market, but equally as to the foreign trade. Orders from the United States are at a standstill, and opinions differ as to the prospects of an early revival of this branch of trade. The opening of the shipping season in the north of Europe has not as yet been followed by any flow of orders into this country. Prices generally show no sign of strengthening, and most of the mills and forges are on reduced time. There is little doing in pig-iron, buyers showing a reluctance to enter into fresh contracts, even at reduced rates. The ironstone trade is also very dull. Coal has a limited sale, and prices are falling. The trade, in fact, has not been so dull as it is now at any time during the last nine months, and coalmasters complain that they have gained nothing as a set-off against the advance in wages made four or five months ago. At several collieries the scale of pay has been reduced.

SHEFFIELD.—There is a much more hopeful feeling this week in the iron and steel trades of the town and district. Last week some good lots of Bessemer blooms were offered as low as £8 10s. per ton, a fall of 30s. in six weeks. Now, however, there is again an upward movement to note, and £9 5s. is ask for the same descriptions. The market is exceedingly unsteady but there is a feeling manifested to buy at the low rate of the day. There are some heavy stocks of Bessemer, mostly in the hands of consumers; the makers not being large holders as a rule, but they are busy. Foreign irons are very firm in value, but have not advanced in rates during the past fortnight. Demand on account of the makers of cast steels is rapidly removing stocks of foreign irons and this branch of trade is improving. File manufactures are buying best steel largely and discounts in this branch are rapidly decreasing. The file hands have a prospect of continuing good trade and advances of wages. The pig-iron market is again very firm on accounts received from the north which are encouraging and consignments of Derbyshire, andSouth Yorkshirepig to Lancashire and the north are increasingr In some directions here efforts are being made to reopen old iron and steel mills, together with iron and steel furnaces and should trade jump up a reaction in favour of "limiteds" is again feared. The recent recovery in trade caused the share list in local "limiteds" to rise in an unnaturally rapid manner; and it almost as rapidly subsided, but not before public investors had again been "severely bitten" in their rush to obtain shares. Derbyshire irons have remained fairly firm during the late temporary relapse in prices. Again there are inquiries to hand from the States for all classes of railway materials, more especially rails. Manufacturers decline to commit themselves for large lots to the rates of the day, and like the colliers, are in some instances endeavouring to adopt a "sliding scale." This is rather a new feature in the trade, but it points to the fact that an increase in rates is not improbable. The coal market is stagnant at the rates of last week, but coke converters are asking advancing rates. This shows that there is more demand for steel than for local made irons. The old staple trades of the town show renewed activity; very large shipping orders for cutlery of all descriptions have lately come to hand, but many have been refused because of prices. The quotations of last December in ordinary going goods can no longer be taken as a guide, owing to an advance in ebony, hard woods generally, ivory, horn, bone and steel. Many large buyers are stocking goods in the face of the coming advance, and this speculation so far has proved a remunerative one. The Colonial, West and South African demand for Sheffield goods is good, but rates are lower than will be the case three months hence. Taken as a whole trade wears an improving aspect.

SOUTH STAFFORDSHIRE.—The amount of business doing at the shops and factories this week is no less than it was a week ago; and there is confidence that things will before very long take a turn for the better. Merchants and factors here and there report a brighter outlook, and in Scotland prospects are more encouraging than they have been for some time past. The North-West Coast and Yorkshire markets keep in the improved state, but the improvement does not increase. Season goods required in the cultivation of the soil are selling tolerably well in the agricultural districts, but the export business in some cases is below the average of a year ago. South America is, however, buying largely of hoes, spades and shovels. Galvanisers and tube-makers are neither of them so well off; and the same remark refers to the makers of tinplate goods. Safe and strong-room firms are better employed than usual, but the lock trade, as well as the bolt industry, is quiet. The Cape mail delivered on Wednesday morning brought some fair orders to the makers of agricultural and mining tools. Some good contracts on South American account for ships' chandlery and general black ironwork have come to hand, and makers expect similar orders from the United States if a further reduction in iron should encourage business. In the iron trade marked bars remain at £9, and common bars range from £7 5s. down to £6 15s. Sheets (singles) are £10 to £10 10s. Orders are badly needed at some of the works. All-mine pigs are £4 5s. to £4, and cinder pigs £2 10s.

WEST CUMBERLAND.—A very marked change has taken place in the position of this district of late. Six months ago a sudden revival in demand found makers industrially inactive, and every effort was at once made to to increase the production. Since then large orders have been booked, and makers at the present are well sold forward, but there is now next to no demand. Six months ago business was active and the iron works inactive; now the exact contrary position obtains. There is every prospect of the continuance of a dull demand at any rate till towards the close of this season, but in the meantime very little change will take place in the industrial position the works in the district, as very heavy deliveries of all qualities of iron are to be made. Indeed no better proof of of the confidence felt in an early revival in demand could be shown than in the fact that several furnaces are undergoing the wotk of preparation prior to being put in blast. It is anticipated that the output of iron will be increased in a month or two by the blowing-in of some half-dozen furnaces. The steelworks throughout the district are busily employed; the chief output is steel rails, but merchat qualities are securing a good market. Makers have their order-books well lined, and they are working full time with all their mills. The same may be said of finished-iron workers, who are busily employed on all classes of work. There has been a very marked growth in the finished-iron industry during the past half year, and whereas it was prophesied with the advance of the steel age there would be less and less demand for finished iron, the reverse has proved to be the case; but manufacturers are displaying their wisdom in the new machinery they are putting down by having it suitable both for iron and steel manufacture. Iron ore is easier in tone, and prices vary from 23s. to 25s. per ton at mines. The coal trade is quiet and unsteady. There is only a small Irish trade, and the domestic demand has fallen off.

CONTINENTAL MINING AND METALLURGY.

FRANCE.

THE *Bulletin* published on April 26th by the French Forgemasters' Association gives the following statistics of French metallurgical imports and exports for the first three months of the present year, as follows:—

	1880. tons.	1879. tons.
Imports:—Pig	40,326	40,910
Irons and plates	19,899	12,293
Steels	1,654	1,409
Exports (all classes)	38,836	34,448

The total imports for 1880 are 61,880 tons against 54,612 tons last year. This increase of 7267 tons, or rather more than 15 per cent., is attributed by the *Bulletin* to duty-free plates imported by the department of the Seine. The total exports show an increase of 4388 tons, or of 12 per cent. over 1879. The increase is attributed to finished goods exported. The exports of ores were 17,739 tons and 13,563 tons respectively for this year and last, the imports 220,542 tons and 215,776 tons. The imports are an increase of 2 per cent. on last year, Belgian ores showing a large increase, and Spanish, Italian and Algerian each a slight decrease.

The following weights of metal passed the octroi barriers at Paris during the first two months of the present year:—4905 tons (2322 tons in 1879); castings, 4777 tons (2482 tons last year). The official declaration of the state of the market, always an important announcement in the *Bulletin*, is that "there is no change in iron quotations at Paris; the rates of 260 fr. and 270 fr. are maintained. There have been several very quiet weeks, but for some days past business has been brisk."

Attention is called by the Comité to the spread of metallic superstructure for railways. In France as little has been done as in England in any serious attempt to find metallic substitutes for wooden sleepers. The French Tramways Company has a longrine carrying a tramrail, but this is almost the only type of metallic sleeper known in France. In Germany over 500 miles of heavily-worked way are laid with Hilf sleepers; and 800,000 Vautherin metallic cross sleepers are stated by the Comité to have been laid in Egypt, Algeria, Belgium, and Holland.

The Commission appointed to examine the Bill repealing or reforming the mining law of April 21st, 1810, has presented its report to the Chamber of Deputies. Ironstone mining is rendered difficult in many cases by the law of 1810, and the modifications of it made in 1866 have not removed all obstacles to the free getting of ironstone. It is proposed to sacrifice, in certain cases, open workings, or *minières* to *mines* properly so called, the mine owner being authorised to buy up the minière owner. Any modification of the present mining law will, of course, affect Algeria equally with France.

The current of business in the Paris market, judged by the majority of reports received from it, seems to resemble, if we may be so figurative, one of those rivers in which a lighter and swifter body of water flows on top of a heavier and slower. Speculators are selling over the backs of makers, and the bulk of current trade is in their hands. But makers are full of work, and keep up a steady supply of goods in fulfilment of old contracts. It is, indeed, goods made under them to dealers' orders which are being sold over their heads. It is doubtful how long the genuine market will remain unaffected by the convulsions caused in current buying by speculative action; so far, buyers keep out of the way, and the end of June is looked to as a period when the market will have definitively recovered or lost its tone. At present the anticipations of the trade are hopeful, as in the various iron-making departments there is no falling off in make, but the sluggishness of business now is as abnormal as its activity in the past winter months. Building irons continue to be the only variety for which the demand at Paris is really strong. For rails of light section for tramway and road-railway lines a large demand is anticipated.

In Haute-Marne prices are well maintained on the basis of £10 12s. for mixed irons. Axle makers are full of orders; unfinished axles are quoted at £10 12s., finished at £14 12s. Castings are brisk; a slight rise is noted in rain-water piping, for which £8 is a common quotation. In the Nord, prices remain on their former footing. A slight indication of increased prosperity is shown in the request made to their employers by the journeymen founders, engine fitters and boiler makers of Lille to reduce the working day by one hour without alteration of wages.

The Happy Land of modern metallurgy seems decidedly to be the region of the Rhone and Loire. The reports sent therefrom are tinged with a rose colour which is nowhere else visible on this year's business map. Unfortunately this district suffers from the monopolisation of a single reporter, and the general public are deprived of all the wholesome advantages that would arise from a competition of intelligence. Accepting what is stated, we learn that the iron and steelworks of the Rhone and Loire are careless about the fluctuations going on all round, and note them only because the prices of pig and fuel have declined. Stocks are lowering, demands are rising. Ferro-manganese sells, principally to America, at £20 a ton to-day, at £25 to-morrow. The St. Louis Ironworks, that is, ferro-manganese works, are having a splendid run of business.

It is well known that there are metallurgical relations between the Centre of France and the South of Russia. Two French steelworks in the Loire district are now said to have undertaken business in Northern Russia, having bought the St. Petersburg Shipbuilding Works, in which are made most of the ships belonging to the Russian navy. These works have been resold by its purchasers to a French Credit Company, which will raise the capital necessary for carrying them on, while the two metallurgical companies in question will have secured to them a monopoly of the manufacture of the forgings required in the shipbuilding works. The Huta-Bankowa works, in South Russia, a Franco-Russian concern, is stated to have made a gross profit of £32,000 in the half year July to December, 1879.

The *Revue Industrielle* recommends an alloy of 7 or 8 parts lead to 1 zinc for coating sheet iron as a better preservative of it than lead, zinc or tin separately. A little antimony added to the alloy improves it.

The exploring party sent out under M. Choisy to examine the Sahara, with a view to level it for a Trans-saharian railway, has completed its work and returned to Algiers.

Towards the long-pending settlement of a commercial treaty between England and France a satisfactory step has been taken by the appointment of the liberal-minded economist, M. Léon Say, to the post of Ambassador to the English Court. When the tariff discussion is over in the French Chamber there is some possibility that the question of a commercial treaty with America will be entertained by the Government of France. On Saturday last the old duty of 1 fr. 20 (1s.) per ton on imported coal was agreed to by the Chamber of Deputies, which also accepted the proposal of the Government to substitute 60 fr. (£2 7s. 6d.) per ton duty on steel rails for the 75 fr. (£2 19s. 6d.) put forward by the Tariff Commission. In the course of the tariff discussion on the 24th inst. complaint was made of the favour shown to English coal by the railways, and M. Michaut stated that he wrote to the railway companies for an explanation of the anomaly that a ton of English coal is carried from Calais to Paris for 7 fr., while 7 fr. is charged for the carriage of French coal from Lens to Paris—a journey 100 kilometres (62 miles) shorter. Mr. Michaut received for reply that it was in the interest of the companies to stimulate traffic; that if they helped to make foreign competition possible they acquired so much the more carrying trade. It also came out that the coal owners of the Gard have agreed among themselves to export a certain tonnage of their output every year to the Mediterranean, no matter whether at a loss or not, the reason given for this being that the carriage of coal was so costly in France there would be no possibility of keeping down otherwise the excess of output, and thus, of course, stifling competition. French coal, therefore, is to be sometimes met with, cheaper out of France than in it; the manœuvre reminds us of the way in which Dutch merchants in old days kept up market quotations for mace and nutmegs.

BELGIUM.—The Belgium market remains in its wearisome condition of unstable equilibrium. Bars continue to be quoted at 180 fr. at Liége, and 170 fr. at Charleroi. But that is only because orders are so small it is not worth while to bargain about them. Mills are running actively enough, but their make is put on the market by middlemen who are all anxiety to realise. Nothing is heard of the large "colonial"—*i.e.*, Indian, Chinese, Japanese, Australian and South American—trade, which a little while since had begun to fill every mill in Belgium with lucrative orders. But tenders for the long-desired lot of 2000 goods vans and trucks have at last been opened, and are now waiting to be confirmed before this not inconsiderable crumb of comfort is fairly dropped into the outstretched palm of Belgian trade. There was only one non-Belgian offers made, a German offer, and this was 15 per cent. higher than the highest Belgian. The Brussels *Intérêts* compare the rates of tenders in October, 1879—one of the deadest periods of trade—with those disclosed on the 21st inst., but warns its readers that the terms of the specification on the latter of these two occasions were harder to comply with than those of last October:—

	Oct., 1879. £	s.	April, 1880. £	s.
10-ton lowries	76	8	95	0
10-ton coal trucks	85	12	117	4
10-ton coal trucks	100	0	125	0
Closed vans, 10 tons ..	138	16	175	6
20-ton lowries	169	8	218	0

Building irons do not appear to be gaining ground, and steel is losing it; pig is less weak than might be expected. At the Brussels Exchange quotations on the 21st inst. were for steel: rails, 265 fr. (£10 12s.); tires, 300 fr. (£12). Iron: beams, 175 fr. (£7); plates, 220 fr. (£8 16s.) Pig: forge, 90 fr. (£3 11s. 6d.); foundry, ditto; English, 65 fr. (£2 11s. 6d.)

The mounting at Rhymney, in South Wales, of rail mill engines built by the Cockerill Company at Seraing is regarded with great satisfaction in Belgium. The *Journal de Liége* reprints the report of their being started which appeared in a Cardiff paper of the 14th inst. The Cockerill Company, we learn from the Brussels *Intérêts*, is laying itself out again for the manufacture of artillery, and at the Brussels Exhibition, which is shortly to open, will show a couple of field pieces and a siege gun. We have already stated how the metallic framework of the Exhibition was put up by the Cockerill Company with mathematical exactitude and a steadiness which did not flinch from the severities of last winter. It now appears that the fitters employed were chosen from amongst workmen who had been acclimatised in Russia. It is terrible to think of the variety of resources at the disposal of so powerful a company as the John Cockerill. There will be some superb specimens, it is said, of art-forging in iron shown at the Exhibition just mentioned.

The London correspondent of the Antwerp *Precurseur* gives, under date the 18th inst., an exceedingly sympathetic and well-written account of the life and labours of Sir Henry Bessemer, and asks the King of the Belgians, who is an older "Turner" than Sir Henry, "to recognise by some act of royal courtesy the services which his new and illustrious fellow-liveryman has rendered to Belgian metallurgy." There is a fine manliness in this which is very striking.

Leopold II., King of the Belgians, publishes in the *Moniteur* of the 23rd, the subject of the great £1000 prize essay, which will be competed for in 1884. In that year the subject is the development of Belgian agriculture. Essays must be sent in before January 1, 1884.

In the *Moniteur belge* of the 24th is published the list of subjects in which is held the final examination before admission to the title of "Honorary Mining Engineer." They are as follows, with their values in the examination:—

		points.
1.	Mining operations generally	24
2.	Surveying	5
3.	Metallurgy	15
4.	Industrial architecture	15
5.	Railway management	12
6.	Graphics, with reference to foregoing subjects	10
7.	Industrial economy	5
8.	Mining and industrial law	6
9.	English or German language	8
		100

The coal trade of Belgium is dull at slackening rates.

GERMANY.—From Dortmund we learn that the market is fairly in a condition of decline; even plates and steel rails which up to the present time have been able to hold their own, are now retrograding. The demand for bars and wire is considerably reduced; beams, in consequence of the opening of the building season, are a little less sluggish. Most of the western mills have still orders on their books, but fresh business is exceedingly scarce, buyers, as usual, waiting to see how far prices are likely to fall. Pig makers are fairly well occupied, and the firmness in raw material forms the most solid bulwark of the prices of finished goods. Spiegel is quoted at 115s.; forge pig, 90s.; German foundry pig, 90s.; German Bessemer pig, 110s.; bars, 175s.; angles, 185s.; beams, 175s.; boiler plates, 260s.; Bessemer rails, 250s.

The stock of old iron existing in Germany is far from exhausted, if we may judge from the many notices we see of sales by auction of old railway and military material.

The Halle Engineering Works Company pays its shareholders 16 per cent. on its operations for 1879.

Business is rather better in Silesia than in Westphalia;

pig is firm at £3 4s., and fresh business continues to come in.

The exports from Germany were very large during the first two months of the present year. The exports of pig were 35,461 tons, bars, 23,227 tons; rails, 32,040 tons; wire, 13,507 tons; coarse castings, 5314 tons; machinery 5506 tons. The imports amounted to only a fraction of the exports corresponding to them, excepting in the case of tin-plate, in which the exports are less than the imports. Of pig-iron the imports were only 7773 tons. The total tonnage of goods exported corresponds to a consumption of 200,000 tons of pig-iron, or about half the total German make of pig in the two months.

In the first three months of the present year there were made in the mining district of Dortmund (comprising Dortmund, Witten, Bochum, Essen, &c.), 190,000 tons pig-iron, 133,521 tons puddled iron, and 150,947 tons ingot iron. These weights are considerably in excess of those made in the last quarter of 1879, and as compared with the first quarter of that year show an excess of 30,669 tons pig, 20,673 tons malleable iron, and 36,622 tons ingot iron.

On the 1st instant the new organisation for the German State Railways came into force. They are placed under the administration of the Minister for Public Works. Our readers will of course have learned of the failure of the German Government to get by indirect means a footing for colonisation purposes in the South Seas. Westphalian coal has been sent to Samoa, where it has been highly appreciated by the German Colony.

NEW PATENTS.

ALL the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 1608 to No. 1711, being the entries from April 20th, to April 26th.

NEW APPLICATIONS.

Air and Gas Motor Engines.—*H. Williams and J. Malam, Liverpool.* [1692
Anti-Friction Journal-Bearings.—A communication.—*W. Morgan-Brown, London.* [1702
Artificial Fuel.—*W. R. W. Smith, Glasgow, and J. F. M. Pollock, Leeds.* [1632
Artificial Teeth Settings.—A communication.—*G. W. von Nawrocki, Berlin.* [1696
Atmospheric Engines.—*W. W. Harwood, Manfield, Yorkshire.* [1663
Baking and other Powders.—A communication.—*A. M. Clark, London.* [1620
Bankers' Cheques.—*J. A. Muller, London.* [1694
Bicycles.—*E. C. F. Otto, London.* [1673
Brake for Bobbins.—A communication.—*J. C. Mewburn, Fleet Street, London.* [1656
Brickmaking Machinery.—*C. H. Murray, London.* [1711
Bucket Lamps.—*C. T. Brock, South Norwood.* [1698
Cages.—*J. Davis, Birmingham.* [1616
Cigar Holders.—A communication.—*J. W. Jennes and J. Schopper, London.* [1648
Combination Glove and Purse.—*F. W. Wilson, London.* [1675
Compound Fuel.—*L. Konow, Bergen, Norway.* [1627
Cranks.—*N. D. Spartali, Liverpool.* [1706
Derrick Cranes.—*R. Bamforth, Slaithwaite, near Huddersfield.* [1658
Designs on Glass.—*A. Martyn, London.* [1647
Discharging Water.—*J. Chidley, Cutsdean, Worcestershire.* [1636
Distillation of Coal, &c.—*J. G. Beckton, Middlesborough-on-Tees, Yorkshire.* [1661
Door and Window Fastener.—*J. C. Callot, Paris.* [1646
Dredges and Excavators.—*W. F. Batho, London.* [1686
Electric Lamps.—A communication.—*H. J. Haddan, Strand, London.* [1704
Electric Lighting.—A communication.—*W. R. Lake, London.* [1649
Electro-Deposition of Aluminium.—*L. A. Davies, West Brompton, London.* [1705
Engine Governors.—*W. T. Clark, Crick, near Rugby, Warwickshire, and W. H. Ashwell, Bedford.* [1699
Entrenching Tools.—*G. U. Prior, Bath, Somersetshire.* [1625
Excavating Machinery.—A communication.—*E. Edwards, London.* [1691
Fanlight Openers.—*G. Andrews, London.* [1644
Felt Manufacture.—A communication.—*B. Hunt, London.* [1676
Fibres from Textile Plants.—A communication.—*G. Vian, Paris.* [1609
Floors and Ceilings.—*G. Howard, London.* [1617
Furnaces.—A communication.—*C. Pieper, Berlin.* [1633
Furniture Castors.—*V. H. Jones, Coventry.* [1677
Garden Seats.—*M. H. Skinner, Cranbrook, Kent.* [1642
Gas Cooking Apparatus.—*F. W. Hartley, London.* [1662
Gas Engines.—*C. G. Beechey, Nottingham.* [1653
Grain Dressing Apparatus.—A communication.—*A. W. L. Reddie, London.* [1707
Hand Hoe.—A communication.—*A. M. Clark, London.* [1708
Hat Manufacture.—A communication.—*E. Edmonds, Fleet Street, London.* [1670
Hoisting Apparatus.—*F. R. Ellis, Liverpool.* [1622
Holders for Condiments.—*T. White, Birmingham.* [1701
Knife-Cleaning Machines.—*E. M. Knight, Manchester.* [1615
Knife-Cleaning Machines.—*J. Cherk, London.* [1683
Ladies' Dress Holders.—*F. E. Duckham, London.* [1635
Ladies' Dress Suspenders.—*E. L. Parker, Birmingham, and J. Luckock, Harborne, Staffordshire.* [1664
Lamps.—*M. Marichenski, London.* [1659
Letter Boxes.—*T. Harby, Liverpool.* [1640
Locks.—*J. Kaye, Kirkstall, near Leeds.* [1643
Locks, Keyholes, &c.—*W. Harrison, Sheffield.* [1612
Looms.—A communication.—*J. H. Johnson, London.* [1680
Machinery for Rivet Rolling, &c.—A communication.—*A. M. Clark, London.* [1678
Manufacture of Buckets, &c.—*R. R. Gray, Liverpool.* [1650
New Fabric for Horse-Cloths.—*W. Jenkinson, London, and J. F. Mayman, Batley Carr, Dewsbury, Yorkshire.* [1679
Needle Cases.—*J. Welch, Redditch, Worcestershire.* [1652
Ornamental Pile Fabrics.—*J. Orr and J. Ingram, Glasgow, Lanarkshire.* [1668
Packing for Pistons.—*R. L. Barker, Newton Moor, Cheshire.* [1674
Paper Hangings.—*J. Dunn, Newcastle-upon-Tyne.* [1619
Photographs.—*G. C. Bell, New York, U.S.A.* [1637
Plumbago Crucibles.—*S. A. Peto, London.* [1672
Potato Digger.—*E. Loomes, Peterborough.* [1608
Pressure and Temperature Indicators.—*G. E. Pritchett, Bishop's Stortford, Herts.* [1614
Pressure Reducing Apparatus.—A communication.—*F. Wirth, Frankfort-on-the-Main, Germany.* [1684
Production of Ammonia.—*T. G. Young, Kelly, Renfrewshire.* [1700
Protractors.—*H. Johnson, jun., West Bromwich.* [1665
Railway Brake Apparatus.—*E. Hunt, Glasgow.* [16 9
Railway Carriage Couplings.—*C. Lord, Huntingdon.* [1621
Railway Carriages.—*J. W. Dyson and J. W. Stroud, Gosport, Hants.* [1693
Railway Rails.—A communication.—*A. M. Clark, London.* [1626
Raising Grain and other Materials.—A communication.—*E. Edwards, London.* [1651
Removing Excreta.—*F. Breyer, Vienna.* [1638
Reproduction of Designs, &c.—A communication.—*J. H. Johnson, London.* [1666
Securing Wheels and Axles.—*D. Foster, Sheffield.* [1703
Sewing Machinery.—A communication.—*W. R. Lake, London.* [1682
Sewing Machines.—*A. Anderson, S. Mort and J. Walker, Glasgow.* [1710
Sewing Machines.—A communication.—*W. R. Lake, London.* [1618
Smoke Combustion.—*J. Gurney, Headingley, near Leeds.* [1630
Soles of Boots, &c.—*H. B. Fox, Oxton, Cheshire.* [1610
Speed Register.—*B. Tower, London.* [1641
Spinning Machinery.—*J. Camm, Burnley, Lancashire.* [1654
Spinning Machinery.—A communication.—*J. H. Johnson, London.* [1681
Spring Locks.—*G. Andrews, London.* [1645
Stands for Spirits, &c.—*J. C. Grinsell, London.* [1697
Steel.—*J. Haldeman, New York, U.S.A.* [1709
Starting of Wheeled Vehicles.—A communication.—*H. J. Haddan, London.* [1685
Steam Boilers.—A communication.—*C. Pieper, Berlin.* [1631
Steam Pumps.—*C. P. Deane, Springfield, U.S.A.* [1657
Stoves or Fireplaces.—A communication.—*W. R. Lake, London.* [1611
Street Paving.—*W. A. Blake, London.* [1628
Subaqueous Constructions.—A communication.—*W. L. Rutton, London.* [1660
Substitutes for Screw Bolts and Nuts.—*N. Thompson, London.* [1690
Tanning Hides and Skins.—A communication.—*J. H. Johnson, London.* [1623
Taps or Cocks.—*C. Buckland, Swansea.* [1629
Tires for Wheels.—*S. Hill and G. E. Williams, London.* [1687
Tool Handles.—A communication.—*W. R. Lake, London.* [1624
Tramways.—*F. G. M. Stoney, London.* [1667
Tramways.—*J. Gowans, Edinburgh.* [1634
Treatment of Bitumens.—A communication.—*E. P. Alexander, London.* [1615
Utilising Solar Heat.—A communication.—*W. R. Lake, London.* [1663
Ventilating Apparatus.—*G. E. Pritchett, Bishop's Stortford, Herts.* [1613
Waste Water Preventers.—*T. C. Mathews, London.* [1683
Wheels for Railway Vehicles.—A communication.—*W. R. Lake, London.* [1695
Weaving Apparatus.—*P. J. Evans, Brinscombe, Gloucestershire, and H. J. H. King, Newmarket.* [1688
Wedge Lever Metal Bolts.—*G. Andrews, London.* [1671

COMMERCIAL.

ALLNUTT AND WOOD'S IRON FREIGHT REPORT.

RATES of freight for iron cargoes remain about the same as last reported, and the following charters have been effected. Steamers:—Antwerp to Galveston, 24s. 6d. per ton new rails; Cardiff to New York, 13s. 6d. per ton new rails; and from Maryport to Danzig, 9s. per ton for 1000 tons rail ends. A steamer has loaded a cargo of steel rails in Liverpool for Valencia, and a contract has been made to take 2000 tons steel rails Liverpool to Montreal. We have placed by steamer from Glasgow iron pipes for Christiania at 11s. per ton. Sailing vessels have accepted 11s. 6d and 5 per cent. for new rails from Cardiff to New York, and similar cargoes have been fixed from Newport at 11s. to Philadelphia and Baltimore, and this rate has also been paid for pigsiron from Barrow to New York. Sailing vessels have likewise been fixed from Antwerp to New York at 11s. per ton old rails, and for part cargoes of pigsiron from Tyne to Swansea at 6s., and Llanelly at 6s. 6d. per ton. For part cargoes of tires from London to Philadelphia we have closed one vessel at 13s. 6d. per ton.

London, 28th April, 1880.

J. BERGER SPENCE AND CO.'S WEEKLY REPORT.

CHEMICALS.—So far we do not observe any indication that the unfavourable reaction in respect to chemicals is likely to be arrested. The week's business has been adverse in some degree to manufacturers. The numerous speculative parcels of various articles which holders become more and more anxious to quit exercises a decided weakening influence on market values, and makers find themselves compelled to make concessions to buyers. The demand also perceptibly weakens, and this weakness is not confined to the export trade, but becomes more observable in the home branch also. Customers, however, are quickly decreasing their stocks, and in their cautiousness are only buying very sparingly. This policy, while diminishing the number of transactions for the present, prepares the market for a healthy activity, should a favourable change in the position of commerce take place. Bleaching Powder is weaker in value, and more plentiful in supply. Caustic Sodas are somewhat neglected, and sellers are by no means firm in their quotations. Metallic Salts are in decreased demand for the present. Sulphates are barely in so good request as hitherto. Arsenic remains tolerably steady. Acetate of Lime is weaker and offered in increasing quantities.

MINERALS.—The general condition of the mineral markets has certainly not improved during the week. The most favourably situated have perhaps held their position, but where this has been successful it has, at the same time, been exceptional to the majority. There exists a decided tendency towards weakness in respect to most minerals, and large transactions are at a discount. Iron ore of all qualities are more preceptibly neglected, and contractors have in some instances to press deliveries on buyers. Any new business that is subject of negociation is principally in respect to the richer descriptions of ore, whether English or foreign. Lead and copper ores have a considerably weaker inclinarion. Brimstone is in rather less request, and sellers more anxious to quit. Manganese rather holds its own, principally through its comparative scarceness. China clay and ochres are without material alteration.

METALS.—Any fancied semblaace to firmness which may have been noticed in regard to pig-iron during the past week has been totally eliminated during that just closing. The continued decrease in the number and extent of shipping orders, the lack of confidence among the home consumers and the nervous anxiety of holders to quit at the best prices obtainable, have reduced the pig-iron markets to a condition such as certainly has not been experienced for many months past—a condition little short of chronic panic. At Glasgow prices have receded at each meeting, and warrants now stand at 48s. 4½d. per ton, having fallen 5s. per ton since last week. No. 3 Middlesborough stands at 42s. per ton delivery, or a decrease of 4s. per ton. Hematites continue in decreased demand, and makers are more pressing for new business. In Lancashire prices are weakening, and the trade becomes in a more unsatisfactory condition daily. Copper is more difficult of sale notwithstanding several concessions. Tin also continues to recede and is neglected. Lead is weaker, and spelter rather loses its firmness.

GENERAL ITEMS.—Since September 1st last it is estimated that 3000 miles of new railway have been constructed in the United States, while over 12,000 miles of additioual line are to be built during the year. The cost of these enterprises will be about 273 millions of dollars.

Manchester, April 24th, 1880.

PEAT, CHATTOCK AND Co.'s MARKET REPORT.

THE present position of the metal market is most remarkable for the rapid fall in prices which has succeeded the advances has been unparelleled. The present depression seems to have fallen upon nearly all branches of commerce alike, and to be the natural result of eager speculation and over-production. On 28th January last we quoted 140s. per ton for hematite pigs, and now they are to be bought at less than 80s., while other articles have shown enormous declines. Second-hand parcels are still offering, though in diminished volume, and makers in several branches of the iron trade are decreasing production.

Tin plates are still very weak, and buyers have been everywhere holding off during the month. Many holders have been compelled to realise at any figures they could obtain, and there have been consequently great variations in prices, which have ranged from 17s. to 23s. for IC cokes. Reports are current that a movement is in progress among the operatives of South Wales to reduce the make by one-sixth, and it is probable that this plan will come into operation. The result would be a diminution by sixty or seventy boxes monthly. Stocks in the United States are reported very small, while a small but steady business is being transacted. The exports for the three months ending 31st March, as per Board of Trade returns, were:—

	1880. tons.	1879. tons.	1878. tons.
United States	42,071 ..	32,933 ..	24,139
France	792 ..	1,500 ..	1,745
B. N. America ..	1,759 ..	976 ..	985
Australia	447 ..	595 ..	982
Other Countries ..	4,607 ..	7,052 ..	6,511
	49,676	43,056	34,362

TIN.—Concurrently with the general decline in prices, tin has exhibited a sharp fall, with but few small and unimportant ckecks. The market is now tolerably steady at £78, being a decline of £8 per ton since the issue of our last report. Lamb and Flag is quoted £86, but could perhaps be obtained at a little less.

SHEET ZINC.—No busiuess has been done in this article, but the makes are still very firm, and the price of spelter on the Continent maintains itself at £20.

JAMES H. WEAGER AND CO.'S METAL REPORT.

THERE has been but little animation in the metal market during the past week, and prices have considerably dropped. The iron industries, while still engaged upon back contracts and working some new orders for heavy iron for America, are experiencing depreciated values. Nevertheless, makers are not forcing the market, and the opinion pretty generally obtains that the sudden relapse, is but temporary; certainly in most metals the statistical position quite justifies such an impression; large buyers appear to be waiting until middlemen are quite out of the market. Scotch pig-iron: After taking a spurt yesterday, closes easier. Middlesborough brands are better sought after, and are making good shipments. Copper: has slightly recovered itself, and Chili bars have been sold at £61 10s. forward. £60 spot. Tin: is again on the move up, the market classes firm at £80 5s. buyers, for Foreign. English ingots £85 to £86. Lead: Quiet. English pigs £16 10s. Spanish £16 5s. Tinplates: Although prices are decidedly weak, manufacturers look for improvement soon, feeling confident that larger orders will be forthcoming shortly. Of course every one wants to buy at the lowest prices which seems pretty near. Once reached, there is reason to suppose that the rebound will be as rapid as the recent fall, although, perhaps we shall not get the high figures ruling at the commencement of the year. Zinc: 120 tons sold to-day at £23 10s. per ton. Our present prices for metals are:—Iron: bars, Staffordshire, £7 10s. to £8; hoops, £8 15s. to £9; sheets, £10 10s. Copper: Chili slabs for 96 per cent., £60; English ingots and blocks, £66; sheets, sheating and rods, £73; yellow metal sheets and sheathing, £6 5s. Tin: English ingots and blocks, £85; bars 4 cwt. barrels, £86; Foreign, Straits, £80 5s.; Australian, £80 5s. Tinplates: Coke, 19s. to 21s. per box; charcoal, 21s. to 24s. Lead: Spanish pig, £16 5s.; English pig, £16 10s.; bars, £17; pipe, £17 10s.; sheets, £17 5s. Zinc: £23 10s. Spelter, £20.

11, Leadenhall Street, E.C., April 29.

SOUTH WALES COAL AND IRON EXPORTS, MARCH, 1880.

THE exports of coal and iron from all the South Wales ports for last month were very large. The demand for coal abroad must have been good, as all the coal shipping ports of the country have shipped a larger quantity of coal than usual; but the shipments from South Wales show a larger excess than those from the northern ports, and Cardiff still takes the lead as the chief foreign coal shipping port in the country, the coal shipped from Cardiff being considerably greater than the coal shipped from Newcastle. The demand for iron was also large, the iron shipments from the South Wales ports being unusually heavy. No appreciative advance has taken place in the price of coal, and the price of iron remains nearly what it was some months since.

South Wales Exports, March, 1880.

	Coal.	Iron.	Coke.	Pt. Fuel.	Coastwise.
Cardiff	400,706	17,790	550	9,148	68,551
Newport	84,332	11,657	62	nil	67,319
Swansea	70,635	1,803	1,024	15,493	52,742
Llanelly	10,123	nil	nil	nil	11,293

CARDIFF.

The iron shipments were Amsterdam, 18 tons; Bilbao, 64 tons; Barcelona, 218 tons; Brake, 1057 tons; Galatz, 1028 tons; Kurrachee, 3586 tons; New York, 8714 tons; Port Said, 1500 tons; Salonica, 304 tons; St. John's, 301 tons.

Cardiff Shipments, 1880.

	Coal.	Iron.	Coke.	Pt. Fuel.
Jan.	424,759	13,318	1,438	9,430
Feb.	390,851	10,295	2,637	7,402
Mar.	400,706	17,790	550	9,148
	1,216,316	41,403	4,625	25,980

SWANSEA.

The iron shipments were:—Barbadoes, 553 tons; Madras, 1250 tons.

Swansea Shipments, 1880.

	Coal.	Iron.	Coke.	P. fuel.	Coastwise.
Jan.	73,444	848	528	16,782	
Feb.	59,341	333	645	11,380	
Mar.	70,635	1,803	1,024	15,493	
	203,420	2,983	2,197	43,655	

NEWPORT.

The iron shipments were:—Baltimore, 1800 tons; Bilbao, 250 tons; Hennebon, 27 tons; Kurrachee, 1670 tons; New York, 1819 tons; Brazil, 882 tons; Philadelphia, 3153 tons; Porto Torres, 539 tons; Pensacola, 1225 tons; and Trinidad, 392 tons.

Newport Shipments, 1880.

	Coal.	Iron.	Coke.
Jan.	84,675	11,039	398
Feb.	75,488	8,576	573
Mar.	84,332	11,657	62
	244,475	31,273	1,033

LLANELLY.

Llanelly Shipments, 1880.

	Foreign. Coal.	Coastwise. Coal.
January	6,234	7,390
February	5,509	6,972
March	10,123	11,293
	21,866	25,655

Coal Exports from the Whole Country for March.

	Foreign. 1880.	Foreign. 1879.	Coastwise. 1880.	Coastwise. 1879.
Newcastle	354,059	223,973	220,596	213,446
North Shields	20,379	17,520	—	—
South Shields	33,913	30,371	24,746	17,805
Blyth	20,236	11,839	2,120	1,745
Amble	6,407	13,482	8,359	5,850
Sunderland	95,436	91,107	168,405	183,379
Hartlepool	45,836	41,948	41,049	51,308
Ayr	508	478	26,020	22,284
Middlesborough	4,320	1,688	1,597	4,201
Hull	43,500	16,762	1,389	710
Grimsby	13,389	9,885	1,286	1,242
Seaham	3,296	2,210	41,049	36,968
Liverpool	39,612	66,466	28,264	32,041
Cardiff	400,706	361,998	68,511	73,366
Newport	84,332	81,315	67,319	86,922
Swansea	70,635	62,297	52,742	51,665
Grangemouth	7,351	4,697	—	—
Goole	31,766	20,770	3,816	5,654
Llanelly	10,123	8,686	11,293	9,749
Glasgow	14,997	26,157	—	—
Port Glasgow	1,290	—	—	—
Charlestown	17,451	5,961	1,135	385
Alloa	10,902	12,052	918	354
St. David's	7,985	3,647	—	—
Borrowstoness	692	736	1,637	1,865
Troon	6,105	10,476	17,741	17,335
Dundee	3,913	8,598	245	575
Greenock	8,475	8,472	—	—
Granton	4,783	4,812	3,381	3,415
Ardrossan	2,331	3,830	13,481	15,417
Irvine	891	—	9,549	6,207

SCOTCH PIG-IRON.

Annexed is a weekly statement of the shipments during this and the previous three years:—

Week end.	1880 Tons	1879 Tons	1878 Tons	1877 Tons
Jan. 3	6677	4655	2441	3454
10	6689	6069	6085	6500
17	12,288	6291	4532	5141
24	7566	6331	6170	7040
31	13,383	4969	6550	5297
Feb. 7	14,190	6130	5637	6183
14	10,612	7272	5722	5839
21	15,152	8996	5124	6559
28	12,603	8318	7836	8630
March 6	17,968	13,910	6816	8048
" 13	20,985	10,[illegible]3	8662	7280
" 20	20,987	11,167	7725	9312
" 27	23,598	9,463	11,499	10,246
April 3	15,722	12,653	7448	9071
" 10	18,309	12,913	9441	10,721
" 17	15,784	13,228	9513	10,020
" 24	16,279	11,795	8,382	13,390
Total	251,892	154,903	119,583	131,021

NEW COMPANIES.

Almodovar Copper Mining.—For the purpose of carrying on mining operations in Portugal, this company was registered 17th inst., with a capital of £30,000, in £2 shares. An unregistered agreement of the 23rd ult., between Thomas Morston Johnson and E. F. Tremayne, is to be adopted and carried into effect by the company.

Balcarres Gold Mining Company of Southern India.—Upon terms of an agreement of the 13th inst., this company proposes to acquire freehold, leasehold, mining, and other interest in the estates of Balcarres, Henrietta, and Palmerston, situate in the South East Wynaad District of the Madras Presidency, together with all buildings, live and dead stock, and growing crops thereon. It was registered 16th inst., with a capital of £180,000 in £1 shares. The purchase consideration is £100,000, viz., £50,000 in cash and 50,000 fully paid-up shares.

Constancia Gold Mining.—This company was registered 20th inst. with a capital of £60,000, in £1 shares, to acquire mining and other properties in South America or elsewhere. An unregistered agreement of the 15th inst., between William Mathias of the first part, Francis Joseph Lee of the second part, and E. F. Tremayne (the trustee for the company), of the third part, is to be adopted.

Lancashire Steam Firewood.—At Wigan, Bolton, Bury, Rochdale, and elsewhere, this company proposes to trade as timber and firewood merchants. It was registered 15th inst., with a capital of £5000, in £5 shares.

Midland Telephone.—Registered 15th inst., with a capital of £6000 in £5 shares, to construct, maintain and work telephonic lines and apparatus within the United Kingdom.

Ocean Express Steam Navigation.—This company proposes to establish shipping communication between the port of Milford, Pembrokeshire, and New York (U.S.A.), and elsewhere. It was registered 15th inst., with a capital of £2,000,000 in £20 shares, with power to increase.

Piacenza, Bettola and Cremona Tramway.—Upon terms of agreement of the 20th ult., this company proposes to acquire a concession, dated 5th February, 1880, granted by the Government of the province of Piacenza, Italy, to Mr. Robert Fowler Mackenzie, for the construction, equipment, and working of a tramway or railway over the Provincial and National Road from the city of Piacenza to Cremona on the one side, and from the said city to the town of Bettola on other side. The company was registered 10th inst., with a capital of £80,000 in £10 shares. Within ten months of the date of the agreement the contractor is to complete and equip the tramway. The purchase consideration is £160,000, payable as follows:—£80,000 in fully paid shares; £13,000 in debentures; £60,000 in cash; and the remaining £7000 by the payment of the subventions payable by the Government and communes under the said concession.

Stainton Moor Lead Mining.—With a capital of £20,000, in £2 shares, this company proposes to acquire and work certain mines situate at Stainton, in the county of York. Registered 19th inst.

St. Leonards and Hastings United Co-operative Supply Association.—Registered 15th inst., with a capital of £10,000, in £1 shares, to carry on the business of a co-operative society in all branches. Power is also taken to acquire and work collieries.

Talacre and Cronant Mining.—Registered 20th inst., to acquire, upon terms of an unregistered agreement, the leases and businesses of the Talacre Mine. The capital is £20,000 in £2 10s. shares.

Wolverhampton Brick, Tile and Pipe.—Incorporated 17th inst., with a capital of £6000 in £10 shares, to carry on the business of brick, tile and pipe manufacturers.

PARTNERSHIPS DISSOLVED.

Lord Brothers, Todmorden, machine makers; as far as regards S. Lord.—S. Beeching and G. Goose, Mareham-le-Fen and Wood Enderby, steam threshers.—Mason and Adcock, Swadlincote, Derbyshire, earthenware manufacturers.—H. M. Laugher and Co., Birmingham, manufacturing silversmiths; as far as regards H. M. Laugher.—Carr and Moore, Gildersome, Yorkshire, railway waggon builders.—Fenby and George, Leeds, horse-shoe nail manufacturers.—Harris and Mason, Birmingham, Britannia metal ware manufacturers.—Ogan, Malin and Ogan, Dunning's Alley, Bishopsgate Street Without, City, drug and chemical packers, &c.—T. Ryder and Co., Manchester, brewers' engineers.—G. Moore and Son, St. John's Square, Clerkenwell, watch manufacturers.—G. Loe and J. T. Brown, Adelaide Place, London Bridge, architects.—W. Newsome, G. Jowett and C. Rushworth, Sowerby Bridge, Halifax, engineers' tool makers.—J. Pintsch, A. Preuss, J. P. Rickman and H. Pischon, Berlin, and Victoria Chambers, Westminter, patentees and manufacturers of lights for railway carriages.—A. Allen, H. Davis and H. Gill, Kingsland Road, tinplate workers.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[For the present and past week.]

Metal Market, City, Thursday Afternoon, 4 P.M.

(*April* 29, 1880.)

METALS AND ORES.

	April 22. £ s.	£ s.	April 29. £ s.	£ s.
Copper (per ton)—				
Chili, for 96 per cent.	59 5/	—	60 0/	—
Wallaroo	77 0/	78 0/	79 0/	77 0/
Burra Burra	75 0/	76 0/	74 0/	76 0/
English Tough	67 0/	69 0/	66 0/	—
English Ingot best	68 0/	70 0/	67 0/	—
Sheets sheathing and rod	74 0/	—	73 0/	74 0/
Bottoms	79 0/	—	70 0/	—
Ore per unit	0 13/	0 13 6	0 13/	0 13 6
Phosphor Bronze				
Special Bearing Metal (p tn)	116 0/	—	116 0/	—
Other alloys (per ton	123 0/	139 0/	123 0/	139 0/
Tin (per ton)—				
Straits (Cash)	80 0/	—	80 5/	—
Do. for arr.	—	—	—	—
Billiton	—	—	—	—
Banca	—	—	—	—
English Ingots	86 0/	88 0/	85 0/	—
Do. Bars	87 0/	—	86 0/	—
Do. Refined	89 0/	90 0/	88 0/	—
Australian	80 0/	—	80 5/	—
Tin Plates, per box, I.C. coke f.o.b. London	0 20/	0 24/	0 19/	0 21/
IX. do.	0 27/	0 29/	0 24/	0 26/
I.C. charcoal	0 26/	0 30/	0 21/	0 25/
I.X "	0 32/	0 36/	0 27/	0 31/
Lead (per ton)—				
Soft English pig	16 10/	—	16 10/	—
Do. W.B.	—	—	—	—
Spanish soft	16 5/	—	16 5/	—
Do. with silver	—	—	—	—
Sheet milled	17 0/	—	17 0/	—
Red lead	17 10/	—	17 10/	—
White	22 0/	—	22 0/	—
Patent shot	20 10/	—	20 10/	—
Zinc (per ton)—from No. 9 Gauge.				
Sheets, rolled	23 10/	—	23 10/	—
Do., foreign	24 0/	—	24 0/	—
Spelter (per ton)—				
Silesian, com	20 15/	—	20 0/	—
Rhenish	—	—	—	—
English	—	—	—	—
Quicksilver, bot.	6 15/	—	6 15/	—
Antimony ore (per ton)—				
Australian	11 10/	14 10/	11 10/	14 10/
Spanish	—	—	—	—
French Star	69 0/	—	69 0/	—
Regulus—				
Crude (per cwt.)	1 14/	—	1 14/	—
Nickel (per lb.)	0 3/6	—	0 3/6	—
Brass (per lb.)—				
Sheets, 48×24.	0 0/8	—	0 0/8	—
Tubes	0 0/11	0 1/	0 0/11	0 1/
Wire	0 0/8½	—	0 0/8½	—
Yellow metal	0 0/6¾	—	0 0/6¾	0 0/6¾

	April 22. £ s.	£ s.	April 29. £ s.	£ s.
Asbestos (per lb.)	0 0/3	0 0/6½	0 0/3	0 0/6½
Plumbago (per ton)—				
Ceylon lump	0 17/6	—	0 17/6	—
Do. chip	0 10/6	—	0 10/6	—
Do. dust	8 6/	—	8 6/	—
Coals (per ton)—				
East Hartlepool	1 2/	—	1 2/	—
Lambton	1 4/	—	1 4/	—
Tees	1 4/	—	1 4/	—
Hartley	1 2/	—	1 2/	—
Hetton	1 4/	—	1 4/	—
Hawthorn	1 3/	—	1 3/	—
Tunstall	1 2/	—	1 2/	—

IRON.

	April 22. £ s.	£ s.	April 29. £ s.	£ s.
Iron, per ton (at works)*—				
Bars, Welsh, common	7 5/	7 10/	7 0/	—
Do. Best	8 10/	8 15/	7 15/	8 5/
Scotch, Common	9 0/	—	7 0/	7 10/
Do. Best	9 10/	—	8 0/	8 10/
South Stafford, common	7 10/	8 0/	7 10/	8 0/
Do. Best	8 0/	9 0/	8 0/	9 0/
Sheets, singles, Cleveland	9 15/	10 0/	9 15/	10 0/
Staffordshire	10 0/	11 0/	10 0/	11 0/
Do. doubles, Staffordshire	11 10/	12 10/	11 10/	12 10/
Do. Lattens, Staffordshire	13 0/	14 0/	13 0/	14 0/
Plates, Ship, Stafford.	10 0/	10 10/	10 0/	10 10/
Do. Scotch	—	—	—	—
Do. Boiler, Stafford.	10 10/	11 10/	10 10/	11 10/
Hoops, Stafford	9 0/	9 10/	9 0/	9 10/
Nail Rods, Stafford	8 10/	9 0/	8 15/	9 0/
Swedish in Lond.	11 11/	12 0/	11 11/	12 0/
Angle Iron, Welsh	—	—	—	—
Do. Stafford	8 15/	9 10/	8 15/	9 10/
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 10/	—	6 10/	—
Do. Scotch	—	—	—	—
Rails, Welsh	8 0/	8 10/	8 0/	8 10/
Do. Stafford	8 10/	9 10/	8 10/	9 10/
North England	5 5/	—	—	—
Light Rails, Welsh	8 5/	8 15/	8 5/	8 15/
Do. Stafford	8 15/	9 15/	8 15/	9 15/
Pig Iron at Glasgow				
Scotch warrants	2 8/6	—	2 6/6	—
Do. No. 1	2 12/	3 5/	2 9/	3 0/
Cleveland, Tyne or Tees	2 18/	3 0/	2 10/	3 0/
Indian Charcoal, London	—	—	—	—
Wrought Iron Girders	18 0/	24 0/	18 0/	24 0/
Bolts and Nuts	18 0/	21 0/	18 0/	21 0/
Fish Bolts	18 0/	23 0/	18 0/	23 0/
Washers	18 10/	19 0/	18 10/	19 0/
Rivets	15 0/	18 0/	15 0/	18 0/
Spikes	17 10/	19 10/	17 10/	19 10/
Swedish Iron—				
f.o.b. Gottenburg, nett cash.				
Pig	—	—	—	—
Bar, rolled	11 10/	12 0/	11 10/	12 0/
Do. hammered	12 0/	12 10/	12 0/	12 10/
Billets	12 0/	—	12 0/	—
Horse Nail Rods	—	—	—	—
Belgian Iron—				
f.o.b. Antwerp, less 2½ per cent.	8 0/	—	8 0/	—
Bars and Slit Rods, common	Nominal.			
Best				
Best Best				
Hammered				
Puddled Steel				
Bessemer				
Hoops				
Rails				
Rolled Girders				
Steel—				
Best cast	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear	45 0/	—	45 0/	—
Do. single do.	38 0/	40 0/	38 0/	40 0/
English spring med. quality	14 0/	18 0/	14 0/	18 0/
Blister	21 0/	34 0/	21 0/	34 0/
Swedish keg	16 0/	—	16 0/	—
Milan	18 0/	19 0/	18 0/	19 0/
Bessemer rails	10 5/	10 10/	10 5/	10 10/
Scrap (per ton)—				
Old rails for remanufacture, D.H.	6 10/	—	6 10/	—
Ditto flange or bridge	4 10/	6 0/	4 10/	6 0/
Engineers' scrap	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal	2 0/	3 0/	2 0/	3 0/
Old steel scrap	3 15/	4 10/	3 15/	4 10/
Wire—				
Best best drawn killed gal.-tel., Nos. 0 to 6	18 10/	—	18 10/	—
Do. 7 & 8	19 10/	—	19 10/	—
Do. 9	20 5/	—	20 5/	—
Do. 10	21 0/	—	21 0/	—
Do. 11	21 10/	—	21 10/	—
Do. 12	22 10/	—	22 10/	—
Rolled black fencing wire (per ton) 1 to 4	10 10/	—	11 10/	—
Do. 5	12 0/	—	12 0/	—
Do. 6	12 10/	—	12 10/	—
Do. 7	13 0/	—	13 0/	—
Bright Iron Wire (Charcoal wire, 4s. 6d. per bundle extra) per bundle of 63 lb. 0 to 6	0 14 6	—	0 14 6	—
Do. 7 to 8	0 15/	0 15 3	0 15/	0 15 3
Galvanised, 80s. per ton extra.				
Best best annealed drawn fencing wire, per ton 0 to 6	13 15/	—	13 15/	—
Do. 7	13 15/	—	13 15/	—
Do. 8	14 0/	—	14 0/	—
Castings (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 1½ to 2in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 " 4	6 2/6	6 5/	6 2/6	6 5/
Do. 5 " 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 " 16	6 0/	6 2/6	6 0/	6 2/6
Do. 18 " 24	5 17/6	6 0/	5 17/6	6 0/
Bolts and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	19 10/	21 10/	19 10/	21 10/

* The entire ton consists of ten times 100 kilogrammes, or about 30 lb. short of an English ton.

OILS, CHEMICALS, &c.

	April 22. £ s.	£ s.	April 29. £ s.	£ s.
Oils (per ton)—				
Olive, Malaga	—	—	—	—
Do. Gioja	44 10/	—	44 10/	—
Do. Levant	42 0/	43 0/	42 0/	43 0/
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	44 10/	45 0/	44 10/	45 0/
Do. Sicily	45 0/	40 0/	45 0/	40 0/
Seal, pale	30 0/	30 10/	29 0/	29 10/
Seal, yellow	27 0/	—	27 0/	—
Seal, brown	25 0/	—	25 0/	—
Sperm head	73 0/	—	75 0/	—
Cod	20 0/	26 10/	20 0/	26 10/
Whale, pale	26 10/	—	26 10/	—
Do. yellow	25 10/	—	25 10/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—

	APRIL 22. £ s.	£ s.	APRIL 29. £ s.	£ s.
Rapeseed, English, pale	29 10/	—	29 10/	—
Do. brown	27 10/	—	27 10/	—
Foreign Pale	—	—	—	—
Ground nut and Gingelly Madr.	30 10/	31 0/	30 10/	31 0/
Palm oil, fine	31 0/	31 10/	31 0/	31 10/
Palm nut oil	33 0/	—	32 10/	33 0/
Linseed oil	27 5/	—	26 10/	26 15/
Cotton seed oil	26 15/	27 5/	26 10/	27 5/
Lard	42 0/	44 0/	42 0/	44 0/
Cocoanut, Cochin	35 0/	37 0/	35 0/	37 0/
Do. Ceylon	33 0/	—	32 10/	—
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent engine oil (per gal.)	0 3/6	—	0 3/6	—
OIL CAKE (per ton)—				
Linseed, Lndn.	10 0/	11 0/	10 0/	11 0/
American bls.	10 2/6	10 5/	10 2/6	10 5/
Do. bags	9 2/6	9 5/	9 2/6	9 5/
Marseilles	9 5/	—	9 5/	—
Rape, English	5 0/	—	5 0/	—
Do. Foreign	—	—	—	—
Green Cotton	5 17/6	7 0/	5 17/6	7 0/
TALLOW—PYC.	43 0/	—	42 0/	—
S.Americn. Beef	41 0/	—	35 0/	—
Do. Sheep	36 0/	—	33 0/	34 0/
Australian Beef	32 0/	—	30 0/	—
Do. Sheep	34 10/	—	33 0/	34 0/
Rough Town Fat	14 0/	—	14 0/	—
PETROLEUM—				
Fine (per gal.)	0 0/6	—	0 0/5¾	—
Do. spirit	0 0/7¼	—	0 0/7¼	—
TURPENTINE—Spirit—				
French	—	—	—	—
American (casks)	1 15/	—	1 15/	—
WHALEFINS (per. ton)—				
Davis' Straits	1000 0/	—	1000 0/	—
Arctic	950 0/	1000 0/	950 0/	1000 0/
Southern	500 0/	—	500 0/	—
BRIMSTONE (per ton)—				
Rough, 2ds Ind.	7 0/	—	7 0/	—
Do. 3rds, do	5 10/	—	5 10/	—
Roll	9 10/	10 5/	9 10/	10 5/
SULPHUR, Flour (per cwt.)	0 12/9	0 12/6	0 10/9	0 12/6
ACID, (per lb.)				
Acetic, fine	0 0/3	0 0/3 3-14	0 0/3	0 0/3 3-14
Do. common (per gal.)	0 1/5	0 1/6	0 1/5	0 1/6
Citric	0 2/9	—	0 2/9	—
Muriatic fine (per cwt.)	0 4/	0 7/	0 4/	0 7/
Do. common	0 4/	0 5/	0 4/	0 5/
Nitric	0 0/4¼	—	0 0/4¼	—
Oxalic (per lb.)	0 0/5	—	0 0/5	—
Sulphuric, concentrated	0 0/1	—	0 0/1	—
Do. Brown	0 0/0¾	0 0/1	0 0/0¾	0 0/1
Tartaric Crystal	0 1/9	—	0 1/9¼	0 1/9½
Do. Pulv.	0 1/9	—	0 1/9½	—
AMMONIA—				
Carbonate, per lb	0 0/6½	0 0/6¾	0 0/6½	0 0/6¾
Sulphate, White & grey (per ton)	19 0/	—	19 0/	—
ARSENIC—White Lump (per ton)	23 10/	—	23 10/	—
Powdered, do.	11 0/	—	11 0/	—
Bleaching powder	0 8/6	—	0 8/6	—
BORAX, Rfd., do.	3 5/	—	3 5/	—
COPPERAS (ton)	2 15/	3 5/	2 15/	3 5/
BI-SULPHIDE CARBON (per ton)	24 10/	26 0/	24 10/	26 0/
PORTLAND CEMENT—				
1st quality, in cks 400 lb. gross, inc. csks., f.o.b., Thames, per csk	0 9/	—	0 9/	—
Do. in sks, 200lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/6 each.				
Charlton White Paint (per cwt.)	1 12/	—	1 12/	—
Calley's Torbay Paint, Brown	0 30/	—	0 30/	—
Do. Red	0 34/	—	0 34/	—
HYPOPHOSPHITES (per lb.)—				
Iron	0 9/3	0 10/	0 9/3	0 10/
Lime	0 5/3	0 7/	0 5/3	0 7/
Magnesia	0 9/	0 9/	0 9/	0 9/
Manganese	0 9/	0 9/	0 9/	0 9/
Soda	0 5/3	0 6/	0 5/3	0 6/
LEAD (per cwt.)—				
Acetate, best	2 0/	—	2 0/	—
Nitrate	1 15/	—	1 15/	—
Red (per cwt.)	0 23/	—	0 23/	—
White	1 4/	—	1 4/	—
LITHARGE (pr cwt.)	1 1/	—	1 1/	—
LIME (per ton)—				
Acetate, Grey, 85%	19 0/	—	21 0/	—
Do. Brown 70%	14 0/	—	14 0/	—
POTASH—				
Bichromate (lb.)	0 0/6¾	0 0/7	0 0/6¾	0 0/7
Chlorate (pr.lb.)	0 0/7¾	—	0 0/7¾	—
Muriate, 80% ton	6 15/	—	6 15/	—
Pruss. Red (lb.)	0 1/8	0 1/10½	0 1/8	0 1/10½
Do. Yel. lb.	0 0/11¼	0 1/	0 0/11¼	0 1/
Sulphate, 80% (per ton)	9 0/	10 0/	9 0/	10 0/
SALTPETRE (per cwt.)—				
Engl. refnd. kgs.	1 8/3	—	1 8/3	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 19/6	1 1/6	0 19/6	1 1/6
SODA—				
Ash.......... deg.	0 0/1 15-16	0 2/	0 0/1 15-16	0 2/
Bicarb. (per cwt.)	0 12/	—	0 12/	—
Caustic, 60% to 72%	0 12/	0 12/6	0 12/	0 12/6
Nitrate (per ton)	17 0/	—	17 0/	—
Crystals (per ton)	3 10/	—	3 15/	—

* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

PRICES CURRENT OF MANUFACTURED GOODS

OF

BIRMINGHAM AND DISTRICT.

*** This List being compiled exclusively for the pages of IRON, all rights of reproduction are reserved. The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material.

The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

APRIL 29th, 1880.

The hardware market is moving downwards, in accordance with the same movement in the iron trade. Heavy branches show the greatest fall, as we last week stated, in the case of bolts and nuts, gas-tubes, chains, cables, and anchors. This week cut nails are reduced 10s. per ton, and gas-tubes are further reduced; but at present it is impossible to give a correct quotation for these latter, as makers vary a good deal, and are not disposed to quote except for actual specification, buyers likewise being loth to place orders with the rapid decline in iron, and the certainty of heavy goods of this description going down in like proportion. In light hardware the brassfounders in some cases are giving another 2½ discount, and curtain-rings are increased in discount 2½ per cent., now being quoted 45 to 50 per cent. The oddwork makers have now all brought their prices down some 10 per cent., and 6d. per cwt. on heavy brackets, both tinned and black. House bells are this week reduced ½d. per lb. The advance of 5 per cent. made some time ago on padlocks is now withdrawn. Some of the heavy steel toymakers are increasing their discounts. At present we have only advices, however, of hammers and coach winches being down. The present price of cut nails is now 10s. 6d. for 3-inch cut clasp clout and rose; 10s. 5d. for 2½-inch flooring brads; and 13s. 6d. for 1-inch cut lath nails, all at the works. Gas-tubes may be quoted at from 70 to 72½ per cent. delivered. Common bars can now be obtained at £6 15s. at the works in South Staffordshire.

ABRIDGED LIST.

Axles, 15 to 25%; coach ironwork, 10 to 15%; coach and waggon springs, 15 to 20%; Augers, 10 to 20%. **Axes**.—Ship carpenters', /5½ to /6 per lb.; Kent and house carpenters', /5 to /6; ditto, steel polished, /5½ to /7; felling axes, /4¼ to /4¾; polished, /4½ to /6; bright and blued solid steel, /7 to /8; American felling or wedge Axes, steel polished, 1/ to 1/4 per lb.; common **Anvils**, 84 lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27/ to 35/.

Basins, shallow galvanised, 10 inch, 7/ to 7/6 per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard **Bellows**, 42½ to 50%; Best extra nailed Bastard, 37½ to 45%; Best improved long Bristol, 35 to 40%; casters' or moulders', best extra nailed, 12 inch, 30/ per doz. net; common **Smiths' Bellows**, 45 to 50%; Best warranted, extra leather double nailed, 36 to 40%; with movable pipe for shipment 2½% less discount. **Bed screws**, 6 and 7-16 and ½ inch, 10/6 to 11/6 per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and ½ inch nuts, 12/9 to 13/9; Black welded heads, 9/3 to 10/3; common slit heads, 6 and ⅜ and ¼ inch, 9/3 to 10/3; Bright turned notched heads, 6 and 7-16 and ½ inch, 12/9 to 13/9; black notched heads, 10/6 to 11/6 per gross; **Brass head nails**, 40 to 42½%; star head, 35 to 40%; Brass plated countersunk head, 25 to 30%; **Blacksmiths' tongs**, 26/ to 28/ per cwt.; real fine wrought **Box irons**, 20 to 25%; fine cast, 42½ to 60%; middle cast, 42½ to 60%; charcoal box irons—Victoria, 45 to 50%; ordinary charcoal box irons, 55 to 70%; **Bolts**—Straight tower; solid end tower, 65 to 67½%; end Best solid tower, 60 to 65½%; solid end barrel brass knob, 60 to 62½%; japanned Scotch tower bolts, 45 to 50%; painters' brushes, 45 to 65%; Best, 10 to 40%; light galvanised **Buckets**, 12 inch, 38 lb. to the doz., 10/ per doz. net; **Blind cord**, list price net; **Bed hooks and eyes**, 50 to 55% malleable, 62½ to 67½%; Brass chain **Beading**, 30 to 35%; Brass and plate coach beading, 30 to 35%; ashpan moulding, 20 to 30%; **Bottle jacks**—Linwood's, 15 to 20%; Salter's, 30 to 35%; Nicholas's, 15 to 20%; common painted **Beams**, 35% to 65%; Bright round end beams, 40% to 55%; Bright box end beams, 40 to 55%; deep **Copper scales**, 45 to 65%; **Steelyards**, 40 to 60%; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30%; common, with round copper scale, 7 lb., 3/ to 5/; 14 lb., 3/9 to 5/9; 28 lb., 5/ to 8/ each, net; **Bedsteads**, cheap stump, 6 feet by 3 feet 6 in., 7/6 to 9/6 each; cheap French, 6 feet by 3 feet 6 inches, 8/6 to 10/6 each, rising /6 for every 6 inches. **Brass**—Rolled brass, 2 to 12 inches wide, to 30 W.G., /8¾ to /9½ per lb.; Brass sheets, 24 by 48 in., 8 lb. and upwards or 27 W.G., /8¾ to /9½ per lb.; **House bells**, brass rough, /10 to 1/1 per lb.; turned edge, /11¾ to 1/1; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3½ to 1/6 per lb.; clock bells, 1/9 to 1/10; ship and turret bells best, 1/4 to 1/5 **Battery kettles**, 150/ per cwt.; composition sheathing and **Slating nails**, /10 to /10½ per lb.; Brass **Escutcheon pins**, ⅜ by 16 inch, W.G., /10 to /10½. **Brass jelly pans**, with bails, /10½ to /11; without bails, /11½ to 1/ per lb. **Maslin kettles**, cast, 4 to 16 inch, /10 to /11 per lb. **Pinpoints**, 1/3 to 1/4. Brass **Rivets** for boots, 12 to 17, W.G., /9½ to /10 per lb. Brass **Shoe Bills**, 1/1 to 1/2 per lb. Brass **Scale pans**, 1/10 to 1/11; Brass **Toddy kettles**, 15 to 20%. Brass **Tubes**, plain rough, ⅜ inch and above, /9¾ to /10 per lb. Locomotive and marine boiler tubes, seam less from 1⅜ to 4 inch outside diameter, to 14, W.G., /8 to /9.

Copper.—**Copper boat nails**, wrought 1½ by 12 inch, W.G., and upwards, /10½ to 1/1 per lb. Copper 1 boat **Roves**, ½ inch and upwards 1/2½ to 1/3 per lb. Copper **Brads and bills**, same price as tacks. Light round Copper **Kettles**, bare rivets, 1/11½ to 2/ per lb. Light round covered rivets, 1/10 to 1/11½; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/3 to 2/4 per lb.; oval bare rivets raisedown, 2/5 to 2/6 per lb. Copper **Rivets** and washers, 1/ to 1/1 per lb.; Copper **Slating nails**, cut, 1 to 1½ inch and upwards, /11½ to 1/ per lb.; Copper **Scale pans**, 1/11 to 2/2 per lb.; cut Copper **Nails and tacks**, 1 inch and upwards, 1/ to 1/1 per lb.; wrought Copper nails and tack, 1/4 to 1/5 per lb.; Copper **Wire**, 0 to 20 W.G., /10¼ to /11. **Brass cupboard turns**, 45 to 52½%; **Chair webbing**, No. 9, 4/5; 10, 4/8; C9, 4/1; C10, 4/6 per gross of 66 yards; **Carpet rings** 1/ to 1/6 per gross; **Cornice poles**, 2¾ inch, brass best burnished 4/6 per foot, 25 to 35%, 3/4 covered; brass poles, 1/2 per foot, 25 to 35, imitation mahogany cornice poles with ends and rings complete, 2¾ inch, 1/ per foot; light birch ditto, 1/1 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2¾ inch, light, 2/9; middle, 3/7; strong, 4/2 per doz., 20 to 30%; wood cornice pole rings, 2¾ inch, imitation mahogany, 16/ to 18/ per gross net; light birch, 17/ to 19/; real mahogany, 22/ to 25/ per gross net; machine made wire **Chain**, single link, iron, 42½ to 47½%; double link, iron, 37½ to 47½%; single link, brass, 37½ to 47½%; registered double link, brass, 32½ to 37½%; close link brass Chain, 5 to 10% brass oval lamp Chain, 22½ to 27½%; brass Clock Chain, 22½ to 27½%; japanned pillar Chains, 1 yard, 16 by 6, 6/8 to 7/6 per doz.; japanned manger, 1½ yard 16 by 6, 8/3 to 9/6; japanned rack, 1 yard, 18 by 6, 5/6 to 6/6, japanned dog, 1½ yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 11/ to 12/. **Cowties**, a chain, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/; close ring, 7/ to 8/ per doz.; japanned watering chains, 14 by 6, 4/9 to 5/9; tinned watering chains, 5/ to 6/; bullock chains, ⅜ inch hook at each end, 17/ to 18/ backbands, 17/6 to 18/6; short link Chain, plain or twisted, ⅜ inch, 17/ to 18/; ½ inch, 15/ to 16/; 1 inch, 14 to 16/ per cwt.; Cart and plough traces, 20/ to 21/ per cwt. **Chesthandles**, improved japanned, 75 to 77½%; broad plate, strong and extra strong, 15 to 55%, according to strength; railway **Cotterpins**, 55 to 60%; Brass **Curtain rings**, 45 to 50%; Brass **Chair nails**, 40 to 45%; square box **Coffee mills**, 25 to 30%; Common post Coffee mills, 20 to 30%; best brass bushed mills, 40 to 45%; London mills, 35 to 40%; registered **Coffin furniture**, 45%; Common, 70%.

Door springs, X, 75 to 80%; XX, 70 to 72½%; XXX, 65 to 67½%; XXXX, 55 to 60%; brass circular and iron circular, 55 to 60%; brass reliance, 10 to 15%; climax, 5 to 10%; universal, 50 to 60%; paragon, 10 to 15%; smiths', 10 to 15%; O'Connor's patent lever hinge springs, 10 to 15%; O'Connor's vertical spring hinge door spring, 15 to 25%; Gerish's spring hinges, iron, 20 to 25%; brass, 10 to 15%; japanned **Door chains**, 30 to 60%.

Files, 25 to 50%; **Frying pans**, best, 47½ to 57½% common, 55 to 62½%; kitchen **Fireirons**, in sets, /6 to /7 per lb.; tongs only, /6½ to /7; pokers only, /5¾ to /6 per lb. **Fish hooks**, 30 to 35%, best; common, 50 to 55%; light kitchen **Fenders**, 5 inch assorted, 2 feet 6 inches to 3 feet 6 inches, black fronts, 28/ to 29/ per doz.; bright fronts, 31/6 to 34/; Manchester pattern kitchen Fenders, 5 feet 1 inch top, black front, 2 feet 9 inches to 3 feet 3 inches, 37/6 to 41/ per doz.; 3 feet 3 inches to 3 feet 9 inches, 42/6 to 46/. Cut wire **Fencing staples**, 0 to 6, 22/ to 24/ per cwt.

Gridirons, London pattern, fluted, 62½ to 65%; light ditto, 61½ to 67½%; hanging round bar, 50% to 55%; doublet, 37½ to 42½%; round bar /1½ per bar, 57½ to 62½%; best fluted bar, 5½ to 62½%; flat bar, 57½ to 62½%; common flat bar, 57½ to 62½%; common Gridirons, /1, /1½ and /2 per bar, 65 to 70%; **Goffering tongs**, two prongs, 5/6 to 6/6 per doz.; **Gimblets**, 10 to 15%.

Holdfasts, japanned, 20/ to 21/ per cwt. **Hammers**, platelayers' keying, 33/ to 35/; miners', 27/6 to 28/6; sledge, 27/6 to 28/6; stone sledge, 27/6 to 28/6; stone, hand, 28/6 to 30/6; stonemasons' hand, 2 to 6 lb., 28/6 to 30/6; pin maul, 2 to 6 lb., 35/ to 37/ per cwt.; sledge hammers, 6 lb. and upwards, 28/6 to 30/6 per cwt.; riveting hand-hammers, 28/6 to 30/6; miners, not steeled, 22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50%; patent hasps and staples, 20 to 25%. **Cast hinges**, polished joint light patent tariff butts, 200, 45 to 50%; 333, 42½ to 47½%; 564, 35 to 40%; polished joint, best best butts, best best, 45 to 50% ditto light tariff, broad butts, 45 to 50%; best heavy, broad butts, 30 to 35%; **Patent Hinges**, edge butts, light, 60 to 62½%; strong, 40 to 50%; patent Scotch butts, 52½ to 55%; same off broad and narrow. Patent table, bed and back-flap hinges, 50 to 52½%; extra strong bed hinges, 42½ to 55%; patent chest, 45 to 47½%; patent strap, 45 to 55%. H Hinges, 40 to 55%; HL hinges, 40 to 55%; japanned and garnett hinges, double washered, light and strong, 35 to 40%; best best patent London or Lancashire tees, 52½ to 60%; patent light japanned Scotch Tees, 55 to 62½%; light patent hooks and hinges on plate and to drive, 20 to 25%; weighty patent hooks and hinges, weighty Gothic, 21/ to 26/; scolloped edges, not japanned, 22/ to 24/; Scotch japanned, Tees double washered, 20/6 to 23/6; Gothic Scotch japanned, Tees 23/ to 28/; Gothic Scotch, Tees self colour, 17/6 to 25/. **Wrought hinges**, common and best, 35 to 40%; best best, 30 to 35%; heavy wrought hinges, common black, 14/ to 16/ per cwt.; common bright, 16/ to 18/; filed edges, 17/ to 19/; japanned Gothic fancy, 16/ to 20/ per cwt. common bright, broad eye, 19/ to 22/; japanned broad eye fancy, 21 to 22/; best bright, 22/ to 24/; best broad eye, 23/ to 25/; best self-colour frog hooks 25/ to 29/ per cwt.; **Lancashire hinges** wrought, 30 to 35%; **Pressed hinges**, common, 62½ to 65%; best, 52½ to 57½%; common brass butt hinges, 1½ inch sanded, 15/ to 18/ per gross, pairs net; very light, 1½ inch, 9/6 to 12/ per gross, pairs net **horseshoes**, fullered fore, 18/ to 20/; fullered hind, 19/ to 21/; stamped, fore, 18/6 to 20/6; hind, 18/6 to 20/6. **Hollowware**, 40 to 45%; common to best, enamelled, 15 to 20%, delivered in Liverpool, London.

Ironfoundry, general.—Ash grates, 11/ to 12/, air bricks, 2/9 to 3/6, half, single, 3/6 to 4/3, double, 6/3 to 7/; bars and bearers, 9/6 to 10/6 per cwt.; barrow wheels, 10/6 to 11/6; bake pans, 9/6 to 10/6; cart bushes, 11/6 to 13/6; camp ovens, 10/ to 11/; cooking stoves, 12/6 to 13/6; cogs for blocks, 17/ to 19/; cellar grating, 10/6 to 12/6; clock weights, 9/ to 11/; Dutch stoves, 11/ to 13/; dumb bells, common, 9/ to 11/; best best japanned, 19/ to 21/; frying pans, cast handles, 12/6 to 14/6; frying pans with wrought handles, 16/ to 18/; furnaces, up to fifty gallons, /3½ to /4; galvanised furnaces up to fifty gallons, /9 to 1/ per gallon; furnace doors, 12/ to 14/; furnace grates, 9/6 to 11/6; forge backs, 12/6 to 13/6; heaters for box irons, 8/6 to 10/6; heaters for urns, 10/ to 11/; jack wheels, 18/ to 20/; oven doors and frames, 12/ to 14/; pots, three legged, Danish, plumbers', and Nego, 10/ to 12/; plumb bobs, 13/6 to 15/6; pudding pans, 13/6 to 15/; pump spouts, 14/ to 16/; sash weights, 8/6 to 9/6 ditto, with pulleys, 11/ to 13/; shoe anvils, 11/6 to 12/6; slippers 12/6 to 13/6; **Italian irons**, 35 to 50%.

Knitting pins, iron, /4½ to /5 per lb.; steel knitting pins, 15 to 24 W.G., 1/ to 2/6 per lb.; brass knitting pins, 1/4 to 1/6 per lb.; **keys and banks**, 50 to 55%; extra strong plate, 30 to 32½%; extra strong Banbury, pin'd keys, 30 to 35%; brass shutter **knobs**, 55 to 60%; brass cupboard turns, 55 to 60%; brass drawer knobs, 53 to 60%; brass ash pan knobs, 55 to 60%; brass range knobs, 40 to 45%; **kettle ears**, 77½% to 80.

Lock furniture, brass, 60 to 65%; buffalo, 25 to 30%; china lock furniture, 37½ to 42½%; ebony lock furniture, 2¼-inch, Wilkes' spindles, 15/ to 18/ per dozen sets; sham ditto, 8/ to 9/ per dozen sets; **Norfolk latches**, common, best, 65 to 77½% common. **Suffolk latches**, 70 to 72½%; best Suffolk latches, 45 to 55%; tinned struck **ladle bowls**, 4-inch, 15/6 to 16/6; 4½-inch, 18/6 to 20/; 5-inch, 23/ to 25/ per gross net.

Netting, wire, galvanised, 57½% to 62½%, delivered **Cast nails lath**, 10/6 to 11/6 per cwt.; cast wall nails 9/6 to 12/ per cwt.; cast headed bills, ⅜ by 8 ounce, 15 to 16/; fine round cast bills, ⅜-inch, 14/ to 16/; strong round cast bills, ⅜-inch, 13/ to 16/; cast slate pegs, 13 to 17/; cast garden loops, 15/ to 17/ per cwt., all at works. **Patent wrought nails**, 32½ to 37½% per thousand and 27½% those sold as weighty by the cwt.; **patent machine-made horse nails**, 25 to 30%; **cut nails**, clasp, clout or rose nails, 3 inch and upwards, 10/6 to 12/ per cwt. Cut lath nails, 1 inch and upwards, 13/6 to 15/; cut flooring brads, 2½ inch and upwards, 10/3 to 11/9; fine cut tacks, ½ inch, 35/ to 38/ per cwt.; ¾ inch 31/6; 1 inch, 27/6 to 28/6 per cwt.; fine cut joiners' brads, or strong, 1½ inch, 16/ to 18/; 2 inch, 15/ to 17/6; 2½ inch, 15/ to 17/; 3 inch, 14/ to 15/6 per cwt.; cut shoe bills, strong, or 12 W.G., 13/6 to 15/6 per cwt.; middle, or 14 W.G., 13/ to 15/; fine, or 15 W.G., 15/6 to 16/6; fine cut tacks, per packet, 75 to 80%; fine cut brads, per packet, 62½ to 65%; **wrought nails**, long count, 15 to 20%; wrought nails, May, 1826 list, to 32½ 37½%; **wrought Bromsgrove nails**, March, 1878, list, 20 to 22½%; best countersunk clout nails 1, inch, 35/6 to 37/6; 2 inch, 26/ to 27/6; 2½ inch, 22/ to 25/6; best best countersunk and **half-countersunk horse nails**, fine best: Swedish charcoal iron, 17/6 to 19/6% list prices; wrought rose or deck-head **spikes**, 4 inch, 15/6 16/, 5 inch, 15/6 to 16/; 6 inch, 15/ to 16/; fine, /6 to 1/ per cwt. extra; galvanised, 7/ to 8/ per cwt. extra; **wrought rose nails** for India, 2 inch, 10 lb., 21/6 to 22/6; 2½ inch, 13 lb., 20/ to 21/; 3 inch, 20 lb., 19/ to 19/6; **malleable nails**, coffin nails, black, 35 to 40%; white lacquered and gilt, 25 to 30%; sacking; moulders' nails and chaplets, 1½ inch to 3 inch, 28/ to 29/; bright nuggets, 28/6 to 29/; tile pegs, 15/ to 16/ per cwt.; bright nails, 4/ to 5/ extra; tinned nails, 12/ to 13/ extra; galvanised nails, 10/ to 12/ extra; **nuts**, square forged, untapped, ¼ inch, /10 to 1/ per gross; ½ inch, 25/ to 26/ per cwt.; ¾ inch, 23/ to 24/ per cwt.; square forged nuts, tapped, ¼ inch, 1/2 to 1/4 per gross; ½ inch, 30/ to 32/; ¾ inch, 27/ to 29/; forged hexagon, untapped, ¼ inch, 1/10 to 2/; ½ inch, 32/ to 34/; ¾ inch, 27/ to 29/; forged hexagon, tapped, ¼ inch, 2/2 to 2/4; ½ inch, 39/ to 42/; ¾ inch, 31/ to 33/; machine-made nuts, square untapped, ½ inch, 20/ to 22/; ¾ inch 18/ to 20/; 1 inch, 18/ to 20/; square tapped, ½ inch, 25/ to 26/; ¾ inch, 23/ to 25/; 1 inch, 24/ to 26/; machine-made hexagon nuts, untapped, ½ inch, 21/ to 30/; ¾ inch, 22/ to 24/; 1 inch, 22/ to 24/; hexagon tapped, ½ inch, 35/ to 36/; ¾ inch, 30/ to 32/; 1 inch, 28/ to 30/.

Oddwork, tinned and black, 20 to 25%, list; **Paris pointes**, best English, 15/6 to 16/; foreign, 18/ to 20/; **planes**, 25 to 30%; iron **axle pulleys**, 1¾ inch, 12/6 to 18/; brass face axle pulleys, 28/ to 40/ per gross; B. F. and wheel, 48/ to 60/ per gross; brass escutcheon **pins**, ⅜ inch to 16 W. G., 1/ to 1/2 per lb.; bright gimp pins, ⅜ to 19 W. G., /6 to /8 per lb.; black, /7 to /9; brass 1/6 to 1/8 per lb. Japanned cut **gimp pins**, ⅜ inch, /7 to /8 per lb.; tinned, /8 to /9 per lb.; cut clog or coffin pins, japanned, ⅜ inch, /5 to /6; tinned, /7 to /8; brass pin pointes, 1/4 to 1/6; **plate locks**, fine 50 to 52½%; strong, 40 to 42½%; Lancashire plate locks, 25 to 30%; pewter measures, 30 to 35%.

Riddles, 30 to 35%; **Rivets**, iron boot rivets, /3½ to /4 per lb. patent machine-made Rivets, 30 to 35%; wrought tinmen's Rivets, 50 to 55%; round or panhead boiler Rivets, ¼ inch, 23/ to 24/; ⅜ inch, 18/ to 19/; ½ inch, 17/ to 18/; ¾ inch, 16/ to 17/. Delivered in London or Liverpool; machine-made wire Rivets, ⅜ inch, 14/6 to 15/6 per cwt. **Rakes**, light garden Rakes 50 to 60%; light solid end Rakes, 47½ to 50%; bolstered teeth garden Rakes, 50%; solid end bolstered teeth garden Rakes, 40 to 45%.

Spades and Shovels, common, 52½ to 55%; second, 35 to 40%; best 30 to 35%; best strong country Shovels; 25 to 30%; best hammered Spades and Shovels, 5 to 10%; **Ship Scrapers**, black steel blades, 45 to 50%; bright, 42½ to 47½%; cast-steel black, 42½ to 47½%; bright, 37½ to 42½%; best cast-steel black, 35 to 40%; bright, 30 to 35%; iron **Wood Screws**, 65%; brass wood Screws, 60 to 62½%; copper, 35 to 45%; Stove Screws, 50 to 57½%; dowel Screws, 60 to 65%; brass headlock Screws, 40 to 47%; gilt, silvered and plated head Screws, 40 to 45%; jute **Sash cord**, 52½ to 57½%; flax Sash-cord, 25 to 30%; best flax, 5 to 10%; super flax, 7½ to 12½%; extra super flax Sash-cord, 5 to 10%; patent steel ribbon **Sash-line**, 25 to 35%; copper **Sash-chain**, 52½ to 57½%; zinc Sash-chain, 47½ to 52½%; iron prepared, 40 to 45%; copper Sash-cord, 15 to 20%. **Sad irons**, common, 10/6 to 12 per cwt.; best japanned, 14/6 to 16/6; best best japanned, 18/ to 20/ per cwt.; **Shoe heels**, York, No. 1, 3/5 to 3/8; No. 2, 4/ to 4/3; No. 3, 8/ to 8/9 per gross net; Dundee hot turned, 5/9 to 6/3; bright-edge imperial or solid Scotch, 9/6 to 10/; bright York or B, 8/ to 8/6; bright solid, 6/6 to 7/; toe plates, 9/6 to 10/ per gross. **Stair rods**, turned ends, 75 to 80%; solid fancy ends, 60 to 65%; cased tube, 30 to 35%; patent solid ornamental, 35 to 40%. **Sofa Springs**, coppered, 8 by 6 inches, 25/ to 27/ per gross; 9 by 7 in, 21/6 to 23/6; 7 by 7 inches, 17/6 to 19/6 per gross; galvanised **Waterloo Scoops and hods**, 17/6 per doz.; japanned Waterloo scoops and hods, 16 inch. 15/ to 16/; japanned scoops and hods, light, 16 inch, 15 to 16/ per doz.; **Shutter bars**, common spring, broad and double, 75 to 77½%; Scotch iron drop, 77½ to 80%; brass drop, 70 to 72½%; brass drop and catch, 67½ to 70%; registered brass spring box shutter bars, 52½ to 67½%; double-handed brass spring box, 57½ to 65%; **Saddlers' tools**, 5 to 10%; **Stocks and Dies** for smiths' use, 35 to 40%; ditto for engineers, 10 to 20%; **Steel toys**, 10 to 30%.

Traps, bow spring, sham Dorset and real Dorset rabbit traps, 45 to

65%, list prices; common traps, 4 inch, 5/6 to 8/ per doz. net; run traps, 2½ inch, 4/ to 5/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/; axle bridge, 1/4 per lb., 40 to 45%; hawk or pole traps, 54 to 50%; wrought mole traps, japanned, 2/6 to 3/0; galvanised, 3/9 to 4/9. **Tin plates**, I C, 30/ to 32/. **Tinmen's machines** and tools, 5%; brass **Bell Tube**, ⅜ inch and upwards, 1/ to 1/1 per lb.; copper bell Tube, 1/2 to 1/4 per lb.; zinc bell Tube, 45 to 50% list; **Patent cased Tube**, 45 to 50%; cut to lengths, 40 to 45%; burnished and lacquered brass tube, 30 to 35%; polished and lacquered twisted brass tube, 30 to 35%; patent taper iron tube, 30 to 35%; patent cased taper iron tube, 30 to 35%; parallel iron brased tube, 30 to 35%; twisted iron parallel tube, 30 to 35%; patent cased twisted iron parallel tube, 30 to 35%; iron **Gas Tubes**, 70 to 72½%; fittings, 72½ to 75%; iron **Water Tubes**, 60 to 65%; fittings, 62½ to 67½%; iron **Steam Tubes**, 62½ to 65%; fittings, 65 to 67½%; galvanised iron gas Tubes, 57½ to 60%; fittings, 60 to 65%; lap-welded **Boiler Tubes**, 60 to 62½%, delivered in London, Liverpool or Glasgow; table catches, 36 to 40%; ditto, improved brass follow, 20 to 25%; wrought japanned **Tea kettles**, 50 to 60%; galvanised **Turnip skips**, 21 inches, light, 25/ to 26/ per doz.

Vices, common black, 32/ to 34/ per cwt.; common bright, 40/ to 42/ per cwt.; black staples vices, solid box black, 42 to 48/; bright, 41/ to 47/; solid box, black staple, with spherical washer, 40/ to 45/; bright 41/ to 55/.

Washers, light iron, 72½%; heavy washers, 13 to 16 lb., W.G., 12/ to 12/6 per cwt.; ¼ inch thick, 2/ per cwt. extra; 5-16 inch, 3/; ⅜ inch 4/; shook bright washers, 3/ to 3/6 per cwt. extra; **Wall hooks**, 23/ to 25/ per cwt.; **Washing tubs**, galvanised oval, 22 inch, 19/ to 30/; 24 inch, 34/ to 35/; round, 22 inch, 38/ to 40/; **Water bowls**, hammered, list price, 52½ to 57½%; light seamed 9 inch, 8/ per dozen; light wired 9 inch, stamped, 11/ to 12/; **Wove wire** list price, iron, copper and brass, 45 to 50%; iron **Wire**, bright, 0 to 6, 14/6 to 15/0 per cwt.; galvanised, 18/6 to 19/6; fine galvanised iron wire, No. 23, 5/3 to 5/6 per stone 14 lb.; annealed tinned wire No. 18, 4/ to 4/3 per stone 14 lb.; cut tinned bottling wire, No. 22, 4/11 to 5/6 per stone 14 lb.; weaving and binding wire, No. 23, 4/ to 4/4 per stone 14 lb.; bright or annealed fine wire, 23, 5/7 to 5/9 per stone 14 lb. net; cast steel wire, 0 to 6, /9½ per lb.; 10 to 20%; metallic or horticultural wire, 6 to 14, /5½ to /6½ per lb; No. 15, 5¼ to /6; 16 to 20, /5½ to /6½; in 1 lb. rings, 1½ inch diameter, /½ per lb. extra; prepared bright **fencing Wire**, 0 to 6, 14/6 to 15/ per cwt.; annealed drawn fencing wire, 0 to 6, 13/3 to 14/3; annealed drawn galvanised, 0 to 6, 17/6 to 18/6. Bright or annealed steel, 0 to 6, round or oval 16/9 to 17/9 per cwt.; black rolled, 1 to 4, 11/6 to 12/6 per cwt.; galvanised rolled, 1 to 4, 14/9 to 15/9 per cwt.

THE IRON TRADE OF THE PAST FIFTY YEARS.

IN a very handsomely got up chart, about to be issued by the Messrs. Spon, Mr. W. G. Fossick, of 36, Cannon Street, shows diagramatically the prices since 1830 of the various descriptions of pig and manufactured iron. It also gives the quantities productions and exports each year.

From the data given it appears that the production of iron in the United Kingdom increased from 678,417 tons in 1830, to 6,200,000 tons in 1879, the largest production being reached in 1872, when it amounted to 6,741,929 tons The stocks of Scotch pig-iron, which in 1844 amounted to 200,000 tons, reached 250,000 tons in 1845, but fell to 125,000 tons in 1847, when they again commenced to increase, and in 1852 reached 500,000 tons. The lowest point appears to have been touched in 1856, on the termination of the Crimean war, when the total quantity in stock was 100,000 tons, from which point it increased yearly until the end of 1864, when it reached 750,000 tons; by the end of 1867 it had fallen to below 500,000 tons, and then again commenced to show an annual increase until 1870, when it reached 700,000 tons, from which by degrees it diminished till in 1874 it was down to 100,000 tons. It has since continued to increase yearly, and at the end of last year amounted to a little over 750,000 tons. The exports of iron and steel in 1830 amounted to 117,135 tons, and increased each year almost without break, excepting during the Crimean war in 1854-6, and the American civil war in 1861-5, until 1872, when they reached their maximum, viz., 3,382,762 tons; from this they decreased until they reached 2,224,470 tons in 1876, at about which level they continued until last year, when they reached 2,879,834 tons. The price of steel rails, which in 1864 was £17 10s. per ton, fell gradually, until in 1870 it averaged for the first half year £10 per ton; in 1872, and again in 1873, the price once more reached £17 10s. per ton, and by the autumn of last year it had fallen to £4 13s. per ton (about the same price os iron rails), but by the end of the year had risen to £8. Welsh bar and iron rail prices, which may be considered synonymous, are perhaps the most reliable, being less effected by speculative purchases than pig-iron; and is interesting to notice that when a considerable advance in price takes place, it is invariably during the winter months, or berween September and March, and that the price seldom remains at the highest point touched more than a month or two, when it falls as rapidly as it rose, and is generally followed by a second advance and subsequent fall. In 1844 the lowest price of Welsh bars and iron rails was £4 per ton—except for a slight break in the latter part of that year, a continuous rise in price took place to £10 12s. 6d. per ton early in 1845, a year which saw a large amount of capital employed in railway construction—a rapid reaction to £7 7s. 6d., caused by the heavy fall in railway securities was followed by another upward bound to £9 5s. in the autumn, and, despite the panic of 1847, the price remained between £8 and £9 until the close of that year. The collapse of speculation, and the political troubles on the Continent in 1848, caused a rapid fall until the end of the year, when the price was only £4 15s. per ton. The lowest price touched by Scotch pig-iron appears to have been 32s. per ton in 1843; however, in about twelve months, it reached 63s., and in 1845 it was nearly £5 10s. per ton. After many fluctuations, it fell as low as 37s. in the spring of 1852, but before the year was out the price was nearly £4, and the following year, £5. Early in 1865 it had fallen to 40s., but before the end of the year it had risen to 60s. per ton, and by the following spring went up to 75s. The next lowest point touched was 50s. in 1870, from which it improved, almost without a break, to £6 10s. in 1872, and £7 5s. in the beginning of the following year; by last autumn it had again fallen to 40s., but improved to 68s. before the year was out, and has since been as high as 73s. 6d.

Other important points shown by this chart are periods and cycles of upward bounds and periods of depression; thus the chart shows that in 1836, probably owing to the construction of railways, a great upward movement took place in prices; a more or less gradual fall followed until 1843, when renewed building of railways again sent up prices, as we have shown in detail, till the highest point was reached in 1845. Again there was a decadence, until the lowest point was touched in 1852, when the superabundance of bullion began to push up prices, until in the early part of 1853 we have another apex. Comparative steadiness for three or four years, despite the Crimean war, was followed by renewed depression, until the lowest point was reached in 1861. Company-mongering and trade activity in 1863 drove up the price until another apex was reached in the following year. The trade depression subsequent to the panic in 1866 was followed by a great upward bound soon after the conclusion, in 1871, of the Franco-German war, until in 1872, and again in 1873, the highest points ever touched in the history of this chart are shown. The last few years will be in the reader's recollection, and when we mention that the price last year descended very nearly to the prices of 1843 and 1852, the severity of the recent trade depression will be readily understood.

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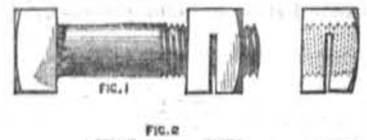

FIG. 1

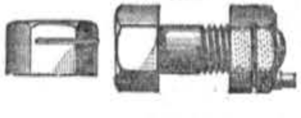

FIG. 2

The advantages of this Lock Nut are as follows:—Simplicity, cheapness, strength, locking on any portion of the bolt without injuring the thread. Fig. 1A shows a RAILWAY FISH NUT with saw-cut partially closed, having been previously tapped, and it is only necessary to screw it upon the bolt in the ordinary manner, when the cut opens and exerts a sufficiently strong spring friction to secure the nut from slacking back by vibration. Fig. 2 shows a nut fitted with set screw, which is more applicable to steam engines and other machinery, especially when the nuts are above 1 inch in diameter, but below that size it is recommended that they should be of steel and applied in the same manner as the fish nut, thereby dispensing with the set screw.

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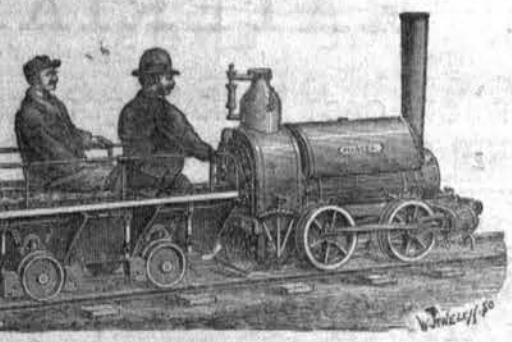

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A NEW YORK city church last fall invested $50,000 in the railroad stock known as "St. Paul Preferred," and made a profit of $60,000. It is proposed to build a new church with it, and it has been suggested to call it "St. Paul Preferred." That's the St. Paul that is generally "preferred" by churches nowadays.—*Detroit Free Press.*

A GOOD DAY'S WORK.—Big work at American iron and steel works, crows the *Bulletin*, is no longer any novelty. The world now knows that America leads all other countries in this department of metallurgical activity. The latest proof of this superiority that has met our notice is the record of one ordinary day's work, of twenty-four hours, at the works of the Pennsylvania Steel Company, at Harrisburg. On the 8th of April the whole number of blows in the converting department was 63, and the product was 399·647 gross tons. In the blooming mill there were bloomed 435·815 tons. In the rail mill there were rolled 1674 50-lb. rails, weighing 373·251 tons. Of these rails 1642 were 30 feet long and 32 were of less length. This is not given as an extraordinary or unusual effort, but is presented as a specimen of the regular work which is done day after day by this company.

A SPOTTER SPOTTED.—It is well known that the New York Central and other railroads employ male and female spotters to travel on the trains by day and night at irregular intervals, in order to catch conductors who are suspected of "knocking down," which is the professional term for dividing profits between employers and the employed. The duty of a "spotter" is to personate an ordinary traveller, buying tickets, exhibiting them at the gates, having them punched for baggage, &c., and reporting all that can be seen or heard. The particular business on the trains is to see that each passenger gives the conductor a ticket or money, that the conductor punches the ticket at once and gives a punched duplex ticket in return for the money fares paid.

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To keep up this system of espionage properly requires a skilful man or woman, as the conductors have keen eyes and readily detect any particular watchfulness on the part of passengers. Of late, women have been employed on the Central road to divert suspicion. They are provided with note-books and ingenious little mirrors, by which, with their backs turned to the conductor, they can see just how many passengers on a coach give up tickets or money for fares. The veils and wraps worn by women readily conceal their movements and disarm suspicion. Men and women who will engage in this sneaking profession will sometimes do meaner things, and frequently their jobs depend upon their making some kind of a report against a conductor, so they are not always pinks of honesty or propriety. A few days ago one of these females got aboard a train going out to Utica. She took one of the front seats in a coach and was seen to keep her hand to her face and peer into the little box which contained two mirrors set at angles so as to reflect all movements made behind her. The honest conductor passed through the coach, collected tickets and received money, giving, as he always does, a punched duplex ticket, as a receipt for the fare. After he had left the coach the woman responded to the flirtations of a drummer who had noted her performances and wished to have some fun. The woman received his attentions cheerfully, and made room for him to divide her seat with her. The drummer was persistent in his attentions, and succeeded in inducing her to leave the train with him at one of the stations. Before doing this he succeeded in reversing her jacket pocket, so that the little mirror, note book, her instructions in trade, schedule of fares and other articles of her trade fell on to the coach seat. The train passed on, and the "spotter" did not miss her "kit" until it was too late. The train boys captured the articles. On the return trip they learned that the drummer had left the woman in the depot, promising to call for her, but forgot his engagement. As she is now well known on this division her career of usefulness is ended, and she will have to "work" some other branch. The joke on the spotter is the source of considerable amusement to railroad men generally.—*Utica (N.Y.) Herald.*

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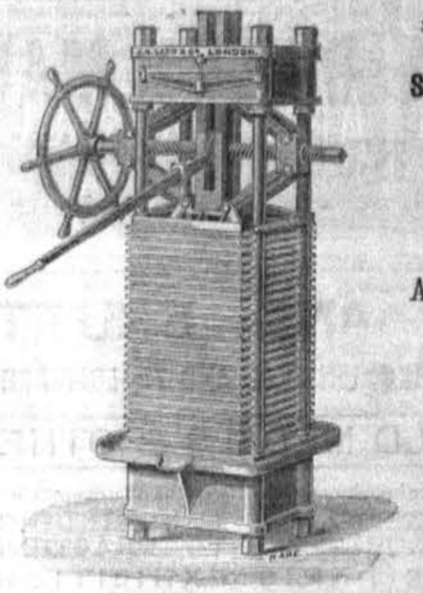

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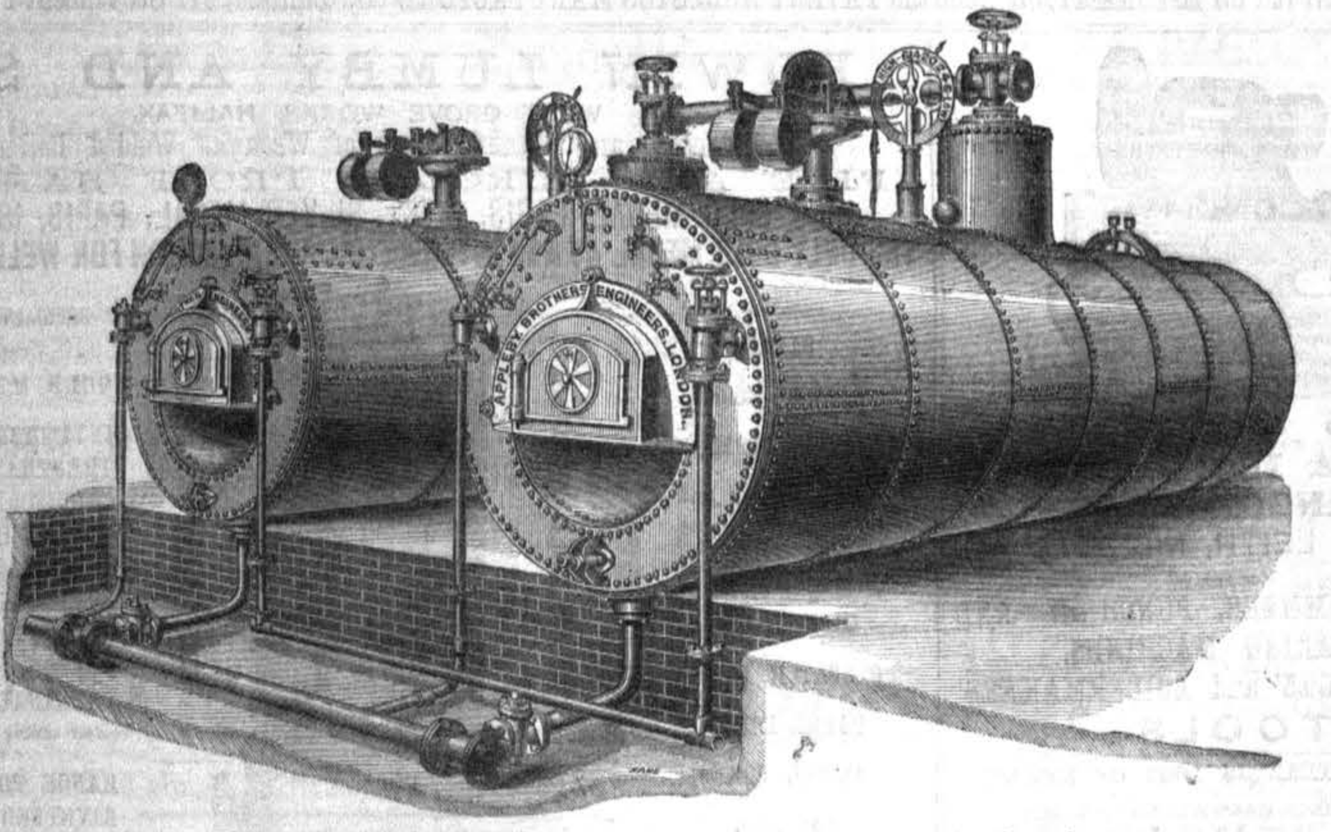

Fig. 46, see Appleby's Handbook of Machinery.—Section 1.

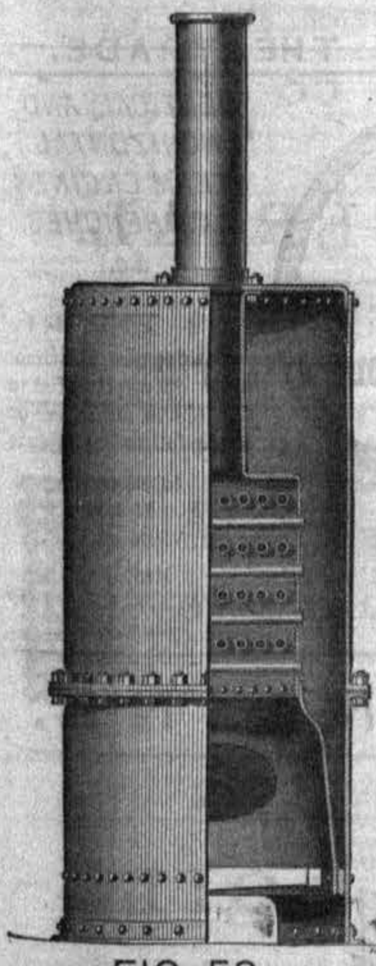

FIG. 53.

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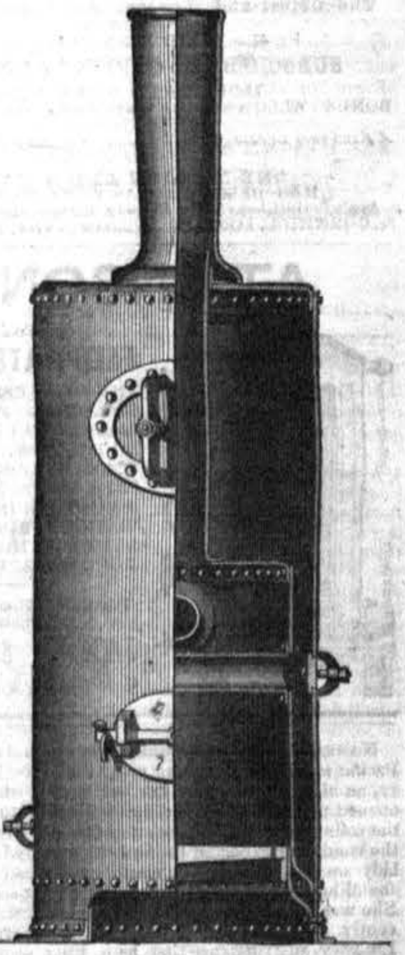

FIG. 52.

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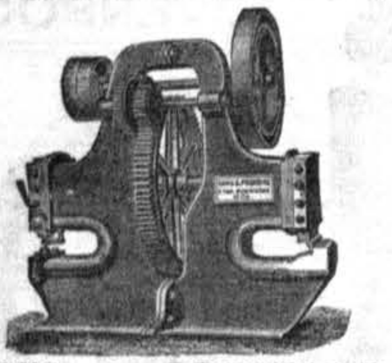

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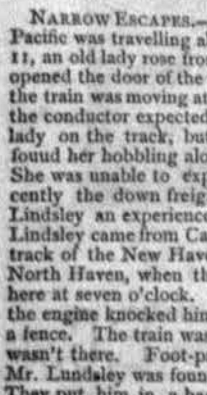

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Narrow Escapes.—While a railway train on the Kansas Pacific was travelling along near Grantville, Kas., on March 11, an old lady rose from her berth, and, while still asleep, opened the door of the car, and walked off the platform. As the train was moving at the rate of twenty-five miles an hour, the conductor expected to find the mangled remains of the lady on the track, but when the train had backed up he found her hobbling along, bruised but not seriously injured. She was unable to explain how she had left the car.—Recently the down freight train for New Haven gave Mr. Lindsley an experience that he will not soon forget. Mr. Lindsley came from Canton, Mass. He was walking on the track of the New Haven road about a half mile this side of North Haven, when the freight train came along that left here at seven o'clock. As he neglected to get off the track, the engine knocked him off, down an embankment and over a fence. The train was stopped to pick up the body, but it wasn't there. Foot-prints led to a farm house, and there Mr. Lundsley was found. He said he was bruised "some." They put him in a baggage car and carried him to New Haven. He then walked to the New York boat and left the state. His experience of Connecticut was sufficient.—*Hartford Courant*, March 25.

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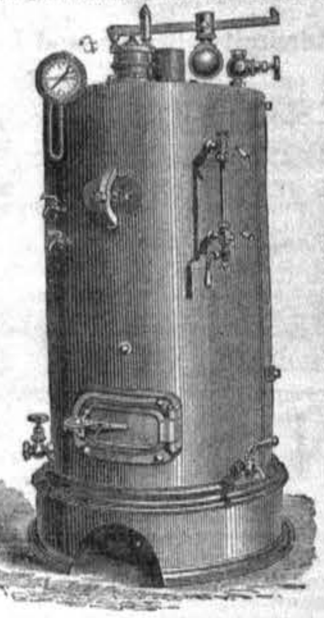

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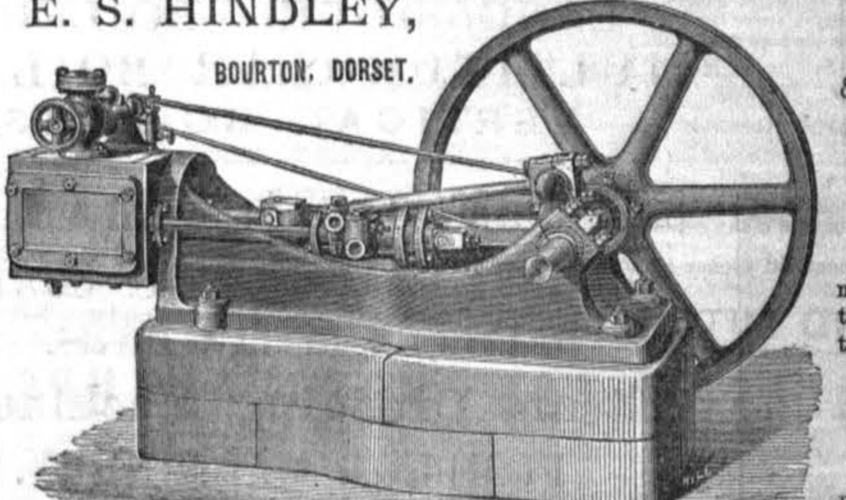

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The FLEXIBLE is a Substitute for **Leather, Rubber, Gutta Percha,** &c., and is extensively used by **Plumbers, Brass Founders, Axle Makers, Hydraulic, Sanitary,** and other **Engineers, Railway Companies, Carriage Builders, Pump Makers, &c.**

It makes the best insertion sheet, and for axle-washers of all kinds it is unequalled.

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"That a pump clack faced with Vulcanised Fibre one half inch thick, was put into work January 13th, 1879, and was taken out July 3rd, 1879, having been in work 171 days. During this time the pump made 741,827 strokes, and raised 74,182,700 gallons. The clacks were previously used with leather facings; these only lasted in work about 40 days; when faced with gutta percha, they last in work about 150 days, but gutta percha is 5s. per lb., whereas the fibre is only 2s."

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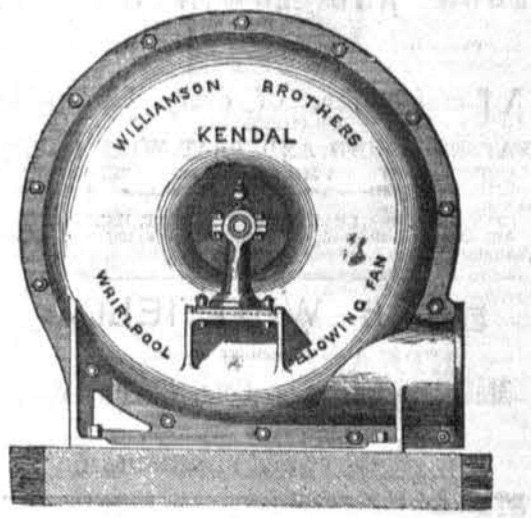

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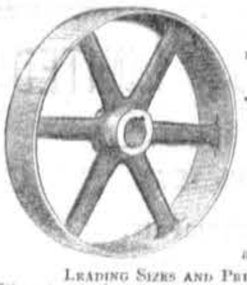

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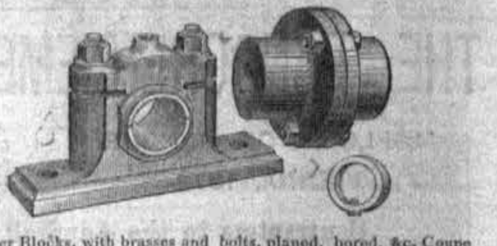
Diameter in inches	6	8	10	12	15	18	21	24	28	32	36	42	48	54	60
Width, ditto ...	2	2	2	3	3	3	3	4	4	4	5	5	5	6	6
Price, Split, shillings ...	8	9	10	11	14	17	20	25	32	38	46	55	66	95	110
Do. Plain do....	5	6	7	8	10	13	16	20	25	30	38	45	55	80	90



Plummer Blocks, with brasses and bolts, planed, bored, &c. Couplings, bored, faced, keywayed, and with turned bolts. Loose Collars of wrought iron bored, turned, and steel screws.

STOCK, SIZES, and PRICES, delivered here.

Bore, in inches to standard ...	1¼	1½	1¾	2	2¼	2½	2¾	3
PLUMMER BLOCK, ...each	6/	7/	9/	12/	15/	18/	22/	27/
COUPLINGS ...pair	8/	9/	11	14/	17/	21	25/	30/
LOOSE COLLARS...each	2/3	2/6	2 9	3/3	3/9	4/3	5/	5
SHAFTING, sup. qual. foot ...	1/5	1/8	2/	2/4	2/10	3/4	3/10	4/

BLAKE'S PATENT DIRECT-ACTING STEAM PUMP

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HYDRAULIC AND GENERAL ENGINEERS,

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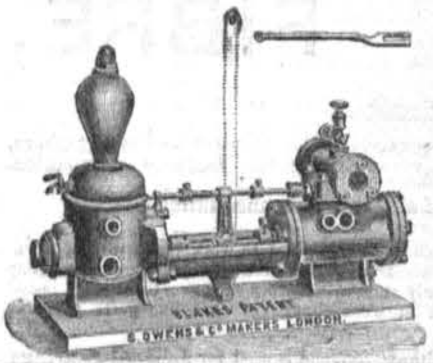
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S. OWENS & Cº MAKERS LONDON.

BLAKE'S PATENT STEAM-PUMPS are suitable for Boiler Feeding, for use in Ironworks, Waterworks and Mines, for working Hydraulic Lifts and Presses, for compressing and exhausting Air, and for a variety of other purposes. They are simple and thoroughly reliable in their action, and will work with equal certainty at slow or quick speeds.

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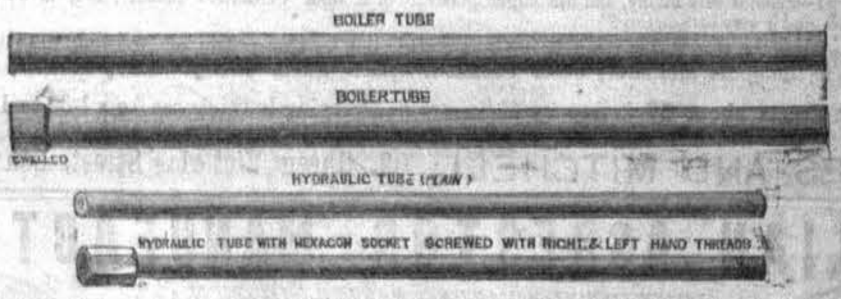
BOILER TUBE
BOILER TUBE
SWELLED
HYDRAULIC TUBE (PLAIN)
HYDRAULIC TUBE WITH HEXAGON SOCKET SCREWED WITH RIGHT & LEFT HAND THREADS

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PURE HYDRO-CARBON OILS specially prepared and adapted for steam cylinders, pistons and valves. Warranted to stand any working temperature without decomposing, and, being absolutely neutral, in no way to affect either metal or packing with which they may come into contact.

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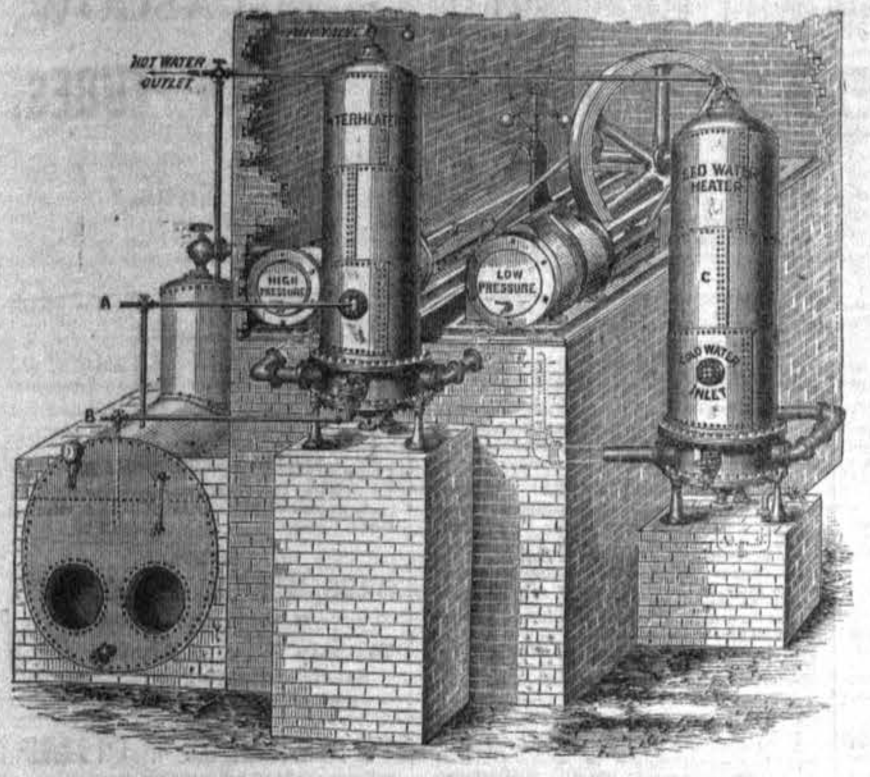

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The Interheater shown in the above sketch is fixed at any convenient distance from the Cylinders in or outside the Engine-room. The Exhaust steam from the High Pressure Cylinder is passed through the inside of the Solid-drawn Bent Brass Tubes in the Interheater, and thence into the Steam Chest of the Low Pressure Cylinders.

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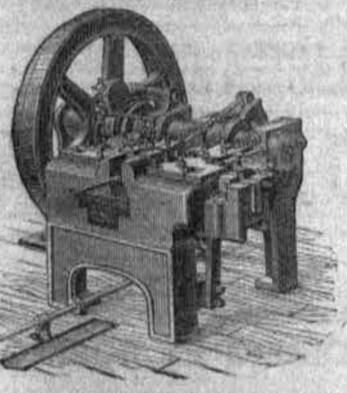

GOLD MEDAL, PARIS UNIVERSAL EXHIBITION OF 1878.

HORSFALL'S PATENT COMBINED BOLT AND NUT FORCING MACHINE.

Makes BOLTS with Square, Hexagon, or Cheese Heads which do not require any DRESSING or FINISHING by HAND, and which are GUARANTEED EQUAL, if not SUPERIOR in STREGTH and every other particular, to the BEST HAND-MADE.

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NO SKILLED LABOUR REQUIRED TO WORK THESE MACHINES.

Over 70 of these Machines have been supplied to Bolt and Nut Manufacturers, Engineers, &c.

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PRIZE MEDALS.

London	1851
London	1862
Paris (class 53)	1867
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Naples	1871
Trieste	1871
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Moscow (Silver)	1872
Brussels (do.)	1876
Manchester and Liverpool	1867
Royal	1869
Royal	1870
Manchester and Liverpool	1871
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WEIGHING MACHINES
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TRAMWAY
WEIGHBRIDGES
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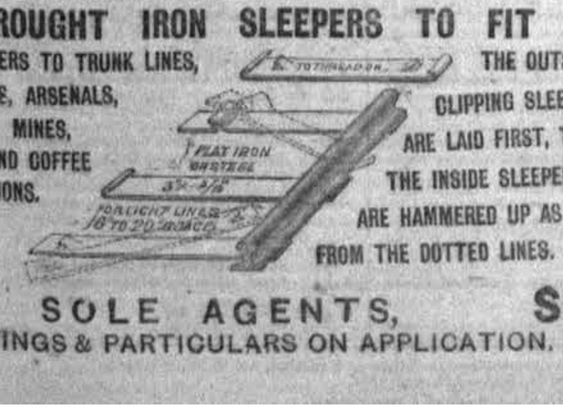
Improved Indicators
for
BILLY FAIRPLAY
MACHINES.

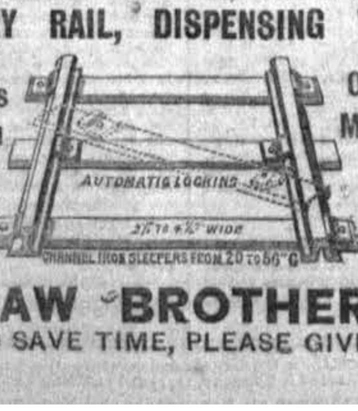
A NARROW GAUGE RAILWAY —**LEGRAND'S PATENT**— COMPLETE IN TWO PARTS, From £250 per Mil

WROUGHT IRON SLEEPERS TO FIT ANY RAIL, DISPENSING WITH SPIKES AND ALL LOOSE PIECES.

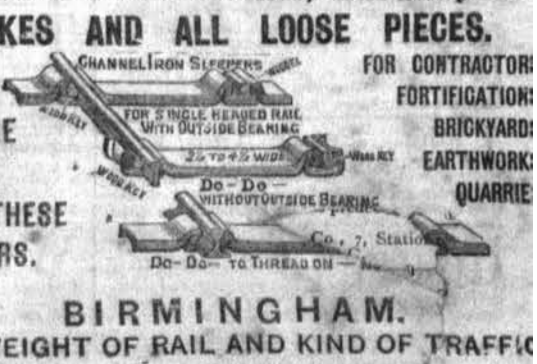
FOR FEEDERS TO TRUNK LINES,
QUAYSIDES, ARSENALS,
FORESTS, MINES,
SUGAR AND COFFEE
PLANTATIONS.



THE OUTSIDE
CLIPPING SLEEPERS
ARE LAID FIRST, THEN
THE INSIDE SLEEPERS
ARE HAMMERED UP AS
FROM THE DOTTED LINES.



OVER 1000
MILES OF LINE
ARE NOW
LAID WITH THESE
SLEEPERS.


CHANNEL IRON SLEEPERS
FOR SINGLE HEADED RAIL WITH OUTSIDE BEARING
WEDGE KEY
2½ TO 4½ WIDE
Do-Do- WITHOUT OUTSIDE BEARING
Do-Do- TO THREAD ON

FOR CONTRACTOR
FORTIFICATION
BRICKYARD
EARTHWORK
QUARRIE

SOLE AGENTS, **SHAW BROTHERS,** BIRMINGHAM.

DRAWINGS & PARTICULARS ON APPLICATION. TO SAVE TIME, PLEASE GIVE GAUGE, WEIGHT OF RAIL AND KIND OF TRAFFI